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[Special Editorial Correspondence.]

THE PHILADELPHIA MEETING OF THE AMERICAN ASSOCIATION.

PHILADELPHIA, PA., Oct. 16th, 1895.

Dear JOURNAL: The first day's session of the Twenty third Annual Meeting of the American Gas Light Association is at an end, and I'm somewhat hard pressed to find a proper starting point for something fairly descriptive of what the day brought forth. There was more than the usual whirl and glitter and din which are the seemingly inevitable accompaniments of gatherings of this sort; and he would not be looked upon as reasonable who said that the Quaker City, in the vicinity of the Continental Hotel at any rate, was "slow" this morning, noon or night. The attendance of delegates and guests, if one may trust to memory for making comparisons, must certainly be in excess of any other attendance in the history of the Association; and, better still, the delegates are confident and smiling, since each one seems to be able to make a better report than the other, when it comes to a matter of revealing the gain in sendout for the last quarter as compared with the figures for the corresponding quarter of 1894. The Association so far was blessed with good weather, and the meeting room is fairly up to the requirements, albeit a trifle on the small side, while the housing afforded by the J. E. Kingsley Company, our "Continental Host," is excellent. Writing of the housing recalls the fact that the Philadelphia hotel men seem to have had the "renewing fever" this year, as witness the changes, completed and underway, at the "Bellevue," the "Lafayette," and so on. However, to the stern facts. President Clark's gavel sounding for order dropped at 10 A.M., and, failing the appearance of Mayor Warwick, who, it was understood, would welcome the visitors, little time was wasted in preliminaries. The report of the Council showed that the membership list was to be increased by the addition of 18 Active and 4 Associate members, but it also had another side in that 17 or more had either resigned or been dropped from the rolls. The Council approved the paper list, as the same virtually appeared in the official notices hitherto printed in the JOURNAL. Some other routine business followed, and then came President Clark's inaugural address.[1] It is quite characteristic of him, for he is a man of opinions, and is not only given to expressing them, but also knows how to express them. The bad feature of his paper is the lengthy necrology roll, on which rests the name of one who worked with might and main and success for the advancement of the Association—the late Samuel G. Stiness—chosen to the Third Vice-President's position at the meeting last year. In connection with the report of the Committee on President's Address, or rather as a corollary of the report, President Clark gave out the information that one of the Past-Presidents, who preferred to remain incognito, following out the suggestion of reward for meritorious research suggested in the Presidential Address, offered the named prizes for competition by the members: $100 for award in 1896, $200 for 1897, and $300 for 1898. Certainly a most liberal and praiseworthy thing to do. The first paper read was that by Mr. W. H. Rogers, of Paterson. During the temporary absence of the author the paper was read by Secretary Slater. A good discussion ensued, and then invitations extending the freedom of the rooms of the Engineers' Club, the Franklin Institute and the Manufacturers' Club were accepted. Next to claim attention was Mr. A. E. Forstall, of Newark, N. J., who presented an admirable paper on "Retort House Design and Practice." He also had prepared an appendix to the original compilation. The reading of the paper proper brought us to recess, and at 2:10 the Forstall appendix was taken up. A spirited and enjoyable discussion wound up an exceedingly interesting technical session, and then came the report of the Nominating Committee, whose recommendations for office bearers for the ensuing year were unanimously indorsed. The officers named were:

President—C. J. R. Humphreys, Lawrence, Mass.

First Vice-President—Irvin Butterworth, Columbus, O.

Second Vice-President—C. H. Nettleton, Birmingham, Conn.

Third Vice-President—J. B. Crockett, San Francisco, Cal.

Secretary and Treasurer—A. B. Slater, Jr., Providence, R. I.

Members of Council—Two-Year Term—D. H. Geggie, Quebec, Canada; E. G. Pratt, Des Moines, Ia.; G. T. Thompson, St. Louis, Mo.; Peter Young, Knoxville, Tenn. *One-Year Term*—A. C. Humphreys, New York City; G. G. Ramsdell, Philadelphia, Pa.; J. Croul, Detroit, Mich.; and A. E. Forstall, Newark, N. J.

1. See JOURNAL, p. 653.

Mr. C. J. R. Humphreys, the President elect, comes fairly by his promotion, for in the old days of the Association his was the yeoman's part in the work. The paper by Mr. A. C. Humphreys was then read. It is needless to say that it was a scholarly production. Some of his views were, we imagine, just a trifle radical to some of his hearers. Then came Mr. Goodwin's illustrated lecture on "Acetylene," and the veteran was fully up to his subject, holding the absorbed attention of his audience for well on to an hour. By-and-large, however, the gas men seem to have arranged the place that acetylene is to hold for them; for the consensus of opinion undoubtedly was, as shown in the discussion, that a helper it might be as an enricher—a thing that would be welcomed mightily just now because of the uncertainty respecting the prices of oil enrichers. Mr. Goodwin well merited the hearty vote of thanks awarded him. This ended the first day's sessions, so far as the technical side was concerned, but the local Committee of Arrangements have seen to it that, of well-regulated entertainment for delegates and guests, there seems no end.—C.

PHILADELPHIA, PA., Oct. 17th, 1895.

Dear JOURNAL: The second day of the convention was ushered in by bright skies and good bracing breezes, and although the early temperature was a trifle cool, as the day wore on the perfection of an October Indian summer spell was the experience of the visitors fair and members brave. The regular proceedings were commenced promptly at the time set, and the initiative was taken by Mr. Frederic Egner, of Norfolk, Va., whose interesting paper on oil storage led to a lively discussion. Then came the number, by Mr. E. G. Pratt, of Des Moines, Iowa, on "Bench Firing with Soft Coal," and his argument, backed by a series of well tabulated figures, was tersely and satisfactorily summed up in the sentence: "With these results I am very well satisfied, and it is our purpose to continue the use of coal for fuel purposes, so long as there is reasonable demand for coke." At this point the Committee on President's Address handed in a supplemental report thereon, which dealt with a specific plan for the proposed awarding of honors gained under the prize system of evoking papers, records of researches, and so on. Then came the paper by Mr. Irvin Butterworth, of Columbus, Ohio, on the "Ventilation of Gas Lighted Rooms." That he treated his theme cleverly goes without saying, and that many of the fraternity are also studying the possibilities of the subject treated by Mr. Butterworth was well assured through the tenor of the discussion that followed the paper. The Butterworth number concluded the regular paper list, and the Question Box was opened with good and fruitful results. The recommendation of the Committee to name place for next meeting, that St. Louis be selected, having been concurred in, the usual votes of thanks were passed, and the technical part of the 23d annual gathering of the American Gas Light Association was declared officially at an end. Meanwhile the Committee of Arrangements were carrying on well sustained work for the entertainment of the women visitors, and there is no getting away from the fact that the vote of thanks passed to the Committee was more than trebly earned. I might mention that a very interesting (yes, more), a guiding feature of the convention, was the "Gas Convention Bulletin," which enabled the delegate and visitor to find out at a glance that which was desired, either in respect of determining what was next on the programme, or to discover where the next "thing was at" or in the Quaker City. Four o'clock saw the "men of the party" on board the steamer Columbia, which, leaving the Chestnut street wharf, steamed north over the broad Delaware, past the famous Cramp shipyards, then south by the Government Navy Yard at League Island, and on to the "new bridge." Thence the course was northward, back again between the wharf-lined shores of Philadelphia and Camden, to Gloucester City, the objective point being the famed factories of the Welsbach Light Company, where is manufactured the improved filament mantle that has done more for the buttressing of gas lighting *per se* than any other invention or discovery in the line of developing the possibilities inherent of gas as an illuminator given to us in the past quarter of a century. Time and your space prevent me from recounting here in appropriate manner the completeness of the Welsbach plant and the varied operations of absorbing interest that were closely scanned by the visitors. From the cotton fiber cloth department to the show room the inspection was complete. One could go where he willed to see what could be seen, and Manager Barrows and Superintendent Stokes are to be honestly congratulated on the complete success of their intelligent efforts to put together a plant that is up to the demands that are certain to be made upon them this winter for the Welsbach wares. If the commercial ends of the concern would only strive as hard to put the selling price of the lamps and mantles on a basis that would be partly as remunerative to the gas men as that price must be to the former, then we would all have a better chance. The general illumination of the factory grounds, the shops and the special pavilion in which the banquet was held, was indescribably beautiful and beyond doubt brilliant. Before joining the banqueters, I might add that a peculiarly graceful acknowledgment of the presence of the fair sex at the 23d convention was the presentation to each of the ladies by the Welsbach Company of a handsome reading lamp—and when I say handsome I know whereof I speak. I hope to send you a paragraph or two about the banquet to-morrow morning.—C.

PHILADELPHIA, PA., Oct. 18, 1895.

Dear JOURNAL: The banquet was a very agreeable affair, the guiding reins being held by Mr. W. H. Gartley, of Philadelphia, who displayed right skill and rare judgment in his guidance of the proceedings. Amongst the speakers who contributed to the "reasonable" part of the entertainment were Gen. Wilson, Capt. W. H. White, M. S. Greenough, Wm. McDonald, A. C. Humphreys, Walton Clark, F. H. Shelton and others. There was no flaw in the entertainment, which was excellently devised and admirably conducted. The guests were back in the Quaker City before the first small hour, all pleased and all happy. To-day is bright and cool, and as I send this from the Market street wharf, just before 10 A.M., the waiting room is almost filled with those who are to make the trip to the famous South Jersey pleasure resort, Atlantic City. Headquarters there are to be at the Hotel Rudolph, and everything points to a fitting termination there of a most successful meeting, which, if I mistake not, is the banner one, in respect of point of attendance, in the Association's history.—C.

The Institution of Gas Engineers in Liverpool.

[From the London *Journal*.]

It was generally believed that the Liverpool autumn fixture of the Incorporated Institution of Gas Engineers would prove popular; and the expectation was justified by the attendance of a numerous party of members on Thursday last (Sept. 26) at the Lime Street Station, when the opening event of the very promising programme—a visit to the Garston works of the Liverpool United Gas Light Company—was entered upon.

The train started at 9:50, and a few minutes took the party to the gas works, which at present occupy an area of 7½ acres of a piece of land 31 acres in extent, acquired by the Company some years ago in view of the future needs of the undertaking in this neighborhood. By the time when it became a practical question of utilizing the site for manufacturing gas, the feasibility of introducing carbureted water gas into England had arisen as a problem of the hour; and Mr. W. King, the Company's Engineer, who was one of the first "on this side" to make a study of the subject, recommended his Directors to try the new system of gas making on the opportunity presented by the pending extension of the Company's manufacturing resources. The advice, fortified as it was by the results of a tour of inspection in the United States, was taken and acted upon; and the contract for the carbureted water gas plant was given to Messrs. Humphreys & Glasgow, with eminently satisfactory results. In preparation for the new departure, however, Mr. King set to work to lay out a portion of the site in the far-seeing and thorough spirit which has long been a tradition of this great undertaking. A large storage gasholder and a relief holder were erected, and a fine example of construction the former is, although (perhaps some would say because) it does not exhibit any leanings towards the fashion of a modified guide framing. The storage of a large quantity of oil was the next consideration; and this has been satisfied by the construction of two circular tanks, each of 1,100 tons capacity. These are based upon a gridiron foundation, so as to be accessible underneath as well as all round for inspection. They are situated in a half sunk and walled pit, so that, in the event of any oil escape and fire, no possible damage to anything else could ensue. Owing to their position, the tanks can be half filled by gravity from railway tanks, run in on a siding from the adjoining railway; and there is a steam pump connection to do the rest. Double valves, and every other precaution that experience and forethought can suggest, have been adopted to make the oil storage absolutely secure.

A plain, substantial brick building, measuring about 155 feet by 55 feet, looking more like a mill than a retort house—which latter type of structure, indeed, it does not in any way suggest—has been built to accommodate the generating plant, which it does with ample room and to spare. At present four sets of generators, with their superheaters and subsidiary appliances, are installed; constituting one-half of the intended equipment of the building. Only one set is actually needed for the present, and it is at work continuously. When filled up, the output of the house will be nominally 7 million cubic feet of carbureted water gas per day; so that the present capacity is 3½ million cubic feet of gas per diem. The quality of gas manufactured is intended to be practically the same, as regards illuminating power, as the ordinary coal gas sent out by the Company—that is to say, 20-candle power (as measured by the aid of a flat-flame burner) in any part of the wide dis-

trict. To insure compliance with this standard, the works send out 21¼-canlde gas; and in order not to fail of giving satisfaction with the new kind of gas, this is made three-quarters of a candle better. For it will be observed that the use of carbureted water gas by the Liverpool Company is not for enrichment, but as a product capable of being distributed and burnt interchangeably with the ordinary supply. This is the only undertaking in England which has up to the present acted in this way in regard to carbureted water gas. The plan has been entirely successful, both economically and technically. The Garston output stands the Liverpool Company in rather less than the cost of an equivalent make of cannel coal gas, and although the specific gravities of the two descriptions of gas differ, none but a few consumers, employing small and poor flat-flame burners, notice when the flames are supplied by the one or the other gas.

It is scarcely necessary now-a-days to describe at length the manufacture of carbureted water gas, at Liverpool or anywhere else. Four-minute blows and seven-minute runs are the rule at Garston, and the whole apparatus works to admiration. The oil used is "Solar Distillate," and the coke is sent in from one of the coal gas manufacturing stations. The gas is purified from carbonic acid and sulphureted hydrogen, and the separated tar is burnt under the boilers. The whole station—buildings, gasholders and manufacturing plant—should certainly be seen by the experienced gas engineer, who will not fail of being struck with a sense of the completeness, soundness and general excellence of everything in and about the station.

The New Water Gas Plant At Blackburn.

[From the London *Journal*.]

There is now in daily operation at the Blackburn Corporation gas works a very complete example—the first of its kind to be started in this country—of the carbureted water gas plant put upon the market by the Economical Gas Apparatus Construction Company, of Toronto and London, who are working under the "Merrifield, Westcott and Pearson" patents. The plant in question has a nominal producing capacity of 1½ million cubic feet per 24 hours. It is in duplicate in all essential parts. One part only is, however, required for use at present, and this only for 12 hours a day, although complete 24-hour trials of the apparatus were made under the supervision of the Gas Engineer to the Corporation (Mr. S. R. Ogden) before the plant was taken over from the constructors. The contract was fully completed, we understand, a month prior to the stipulated time; and the guarantee given by the contractors has been amply covered by the every-day performances of the plant—a "double event" upon which the Corporation and the contractors are together to be congratulated. As the plant stands, it is in all respects a workmanlike and creditable piece of gas engineering, complete to the last particular, with nothing left to be adjusted or made good, or to be in any way corrected. What this means in a new departure of this importance, engineers do not need to be reminded.

The water gas plant has been installed in an old retort house 44 feet square, cleared out for its reception, and provided with two annexes—one containing the steam engines, pumps and blowers, the other accommodating two boilers, either of which could supply steam for the double arrangement of generators and superheaters. The supplementary equipment comprises an underground storage tank for oil, which is filled by gravitation from the railway tanks; an oil service tank which commands the superheaters; and the relief gasholder. The carbureted water gas is made, scrubbed, condensed, and purified by lime (to remove the carbonic acid gas) before being mixed with the coal gas made upon the same works. The engine room contains a pair of No. 8 Sturtevant fans, each driven by a belt from a vertical Tangye engine, a Waller's exhauster, and the oil pumps. This is under the charge of one man. Another man attends upon the generators and gas-making part of the plant; and then there are the boiler and generator furnaces to be fed, and the latter clinkered. This accounts for the whole of the working staff of the new department.

The gas making plant proper comprises a pair of generators, which are oval section, measuring 8 ft. 6 in. by 10 ft. by 14 ft. 6 in. high, closely connected with superheaters 8 ft. 6 in. in diameter by 32 ft. in height. The lower part of these vessels is styled the superheater, up to the level of the upper oil feeds; the portion above this being called the fixing chamber. Water cooled valves are provided, so arranged that the processes of blowing up and gas making can be effected either upwards or in the reverse direction, and the gas, when made, passes through a seal cup, heats the oil supply, and is afterwards scrubbed and condensed. Water is used in the scrubbing process, and this and the residual tar are susbequently run off together into an underground separator—the first of its special kind to be tried in this country—where a perfect separation of the two fluids takes place, so that the water could be used over again if desired, while the tar is burned under the boiler to help the coke used for steam raising.

At the present time, 6-minute blows and 6-minute runs are the working rule, the attendant going simply by the clock, and having all his valves conveniently at hand upon the stage which is erected over the tops of the generators. For every run, he uses 28 gallons of oil, measured by a Worthington oil meter, and he feeds his generators when required with coke delivered to him in tipping wagons sent up by a lift. These contain about 16 cwt. of coke. There being two charging doors to each generator, each side is charged alternately, for the purpose of giving a better distribution of the fuel than a single central door. The furnace only requires clinkering once every 12 hours.

The oil at present used at Blackburn is Russian "Solar Distillate;" but, of course, any description of mineral oil, free from pitch, that could be more cheaply purchased woutd answer the same purpose. It is simply in this regard a matter of proportioning the consumption of oil to the run. The same observation applies to the management of the generator. At Blackburn several descriptions of coal are carbonized; and consequently the quality of the coke supplied to the water gas plant is constantly changing. No trouble in working has, however, been experienced on this score; it being a simple matter to vary the duration of the blow and the run, and by a reversal of the current to insure the distribution of heat in the generator and superheater to the best advantage.

There are many admirable points of well thought-out detail in this Blackburn plant; but these cannot be described at length here, even if we could hope to make them really clear by the aid of letterpress. An engineer's eye would, however, take them in at a glance; and we can confidently assert that it will be worth while for any engineer desirous of keeping abreast of the modern development of carbureted water gas manufacture in this country to proceed to Blackburn and examine the new plant for himself. This is the more desirable as every detail of a plant of this character registers some valuable experience, and in water gas making it is experience rather than the knowledge of first principles which is essential to success.

Now for the results. The carbonizing book was laid open for inspection, and from its pages we took the following data, applying to twelve hours' working on the 16th ult. Actually, the apparatus was at work from 6:10 A.M. to 5:42 P.M., or (in all) 11 hours 32 minutes.

Gas made.....	352,000 cubic feet.	
Oil consumed, 1,072 gallons..=	3.04 gals.	per 1,000 cubic feet.
Coke for generator, 11,088 lbs.=	31.50 lbs.	" "
Boiler fuel coke.....	6.00 lbs.	" "
Illuminating power of gas....	20.65 candles.	
Illuminating power per gal. oil	6.79 candles.	
Candle feet per 1,000 cubic feet	1,358	

This gas was made in 42 runs, averaging 6 minutes per run, in one generator set. The residual tar, as already stated, is burned under the boiler to help the coke. The illuminating power is taken by means of a bar photometer, from the purified gas. On September 19, gas was made for 6 hours only, which is, of course, very unfavorable to the plant. On this occasion, 167,000 cubic feet of gas, of an average illuminating power of 23.04 candles, were made with an oil consumption of 3.42 gallons per 1,000 cubic feet, and 33.2 lbs. of coke for the generator, besides 6.89 lbs. of coke per 1,000 cubic feet for the boiler. In a 24-hour run, the consumption of coke for gas making would not exceed 28 lbs. per 1,000 cubic feet of gas.

On the Possibility of the Occurrence of Hydrogen and Methane in the Atmosphere.

[By Mr. Francis C. Phillips, of the Western University, Allegheny, Pa.]

Whatever may have been the process by which organic remains have in the course of time been caused to yield gas and petroleum, a considerable portion of the gas evolved in the early stages of decay must have escaped into the atmosphere before the burial of such remains under sedimentary deposits, and the consequent imprisonment of the more volatile products could have occurred. This would have been the case if, as in the view of the older geologists, the source of gas and oil is to be looked for in the slow decomposition, at low temperatures, of masses of seaweeds as they were gradually buried under accumulating sediments. It would have occurred likewise if, according to Engler's hypothesis, gas and oil have come from the distillation of animal remains under pressure of overlying sediments and at a gentle heat.

For a long interval of time must have elapsed between the commencement of decay and the final burial of such remains under marine deposits, of sufficient thickness and compactness, as to cause the retention of the hydrocarbons until the sediments became consolidated into rock.

In a paper upon the origin of natural gas[1] I have called attention to the great difference in the nature of the changes which may occur in organic remains submerged under water and protected from atmospheric influences. The early stages of the decay are rapid, and much hydrogen may be produced. The later stages are more gradual, and methane may be a chief product of the decay. At the beginning of the process the cell contents are chiefly concerned in the change. Even if buried under deep sediments the tumultuous nature of the gas evolution must cause the gas bubbles to break through and escape from dense masses of clay and sand.

The following experiment was described in the paper cited: A quantity of a seaweed was allowed to decay under water in an apparatus so constructed that any gas produced could be collected over mercury. Rapid decomposition soon set in and continued for 10 days, when the

1. *Am. Chem. J.*, 16, 417.

evolution of gas apparently ceased, having become much retarded towards the end. In all 803 cc. of gas were collected. Analyses were made of the first portion of 300 cc., of a second portion of 300 cc., and of a third portion of 203 cc. The results are tabulated below:

	First Portion.	Second Portion.	Third Portion.
Carbon dioxide	18.23 per cent.	32.47 per cent.	53.44 per cent.
Carbon monoxide	0 "	0 "	0 "
Ethylene	0 "	0 "	0 "
Methane	0.30 "	0.28 "	0.08 "
Hydrogen	62.24 "	48.97 "	42.02 "
Nitrogen	19.23 "	18.28 "	4.46 "
	100.00	100.00	100.00

The temperature during the experiment did not exceed 20° C.

The same apparatus was kept in position for 2½ years after the above experiment was made. During this time a continuous production of gas was observed, but it was so slow that at the end of this period only about 30 cc. of gas had collected. This was found to consist of methane.

Frankland and Jordan[1] found that grease left to decay under water, air being excluded, evolved gas of the following composition:

	In 2 Days.	In 3 Days.	In 4 Days.
Carbon dioxide	84.63	87.66	84.41
Oxygen	0.13	....	....
Hydrogen	6.90	8.75	9.17
Other combustible gases	2.51	0.71	0.27
Nitrogen	5.83	2.88	2.15

I have examined gas collected from swamps in many localities. Gas samples have been taken from streams having muddy bottoms and in which vegetable remains had accumulated. Carbon dioxide, nitrogen and methane are usually found in shallow swamps. In deeper swamp waters, where masses of vegetable debris of greater thickness occur, hydrogen is often found in small quantities mixed with carbon dioxide, nitrogen and methane.

According to the hypothesis of Mendeleef natural gas and petroleum have been produced by the action of steam at high temperatures upon the metallic compounds of carbon.[2] The general result of experiments upon the heated carbides of iron, manganese and other metals has been to show that in all such cases there is produced mainly hydrogen mixed with relatively small quantities of hydrocarbons. It is found, however, that the natural gas which flows from the wells of Pennsylvania, New York, West Virginia, Ohio and Indiana consists mainly of methane with small quantities of other hydrocarbons, but does not contain free hydrogen. Hence, if we accept the hypothesis of Mendeleef, we must suppose that the natural gas, now flowing from the earth in such vast quantities, represents the diminished residue of a much larger volume of gas from which the free hydrogen has escaped through the overlying rocks. Whatever view is adopted as to the origin of natural gas there seems to be good reason to believe that considerable volumes of hydrogen and of gaseous paraffines have found their way into the atmosphere, and that the process has been continuous since early geological times.

Evolution of carbon dioxide from organic remains is merely one stage in a cycle of changes. The carbon dioxide present in the atmosphere parts with its carbon to growing plants. They, in their turn, yield back carbon dioxide as they die and decay. On the other hand each bubble of hydrogen and of methane, once set free at the earth's surface, probably escapes unoxidized and unabsorbed to ascend into the higher strata of the atmosphere.

Of all the forms which hydrogen and carbon can assume in nature, free hydrogen and methane are among the most stable and unalterable as regards all influences at the earth's surface. Their slight solubility in water protects them still further from oxidation.

In the natural gas regions gas bubbles are easily produced by stirring up the sediments at the bottom in streams, ponds and rivers. This is not only the case where decaying vegetation occurs, but in streams flowing over gravel and pebbles where no decay is in progress. The loose gravel appears merely to arrest temporarily the gas on its way out from the earth, and renders it visible as it escapes in bubbles through the water. If the gas accumulated under gravel and sand in streams be dislodged by stirring, it is usual to find that, in a day or two, or even after a few hours, it has again collected in considerable quantity. Constant agitation of the gravel seems not to diminish the amount of the gas flow.

Such emanations of gas are common in Western Pennsylvania and Western New York, in regions where the occurrence of hard rock directly below the gravel bed of a stream precludes the supposition that the gas has resulted from the decay of recently buried tissues. It is probable that the gas which is continually accumulating in such situations is derived from great depths, that its presence is the result of a slow process of diffusion from below, which only terminates as the gas enters the atmosphere, and that it constitutes a considerable portion of the natural gas which was stored originally in the rocks.

The feebly luminous flame produced by this gas distinguishes it from the nitrogen, which so frequently collects in the sands of river beaches in regions of constant fluctuations of water level due to tides, and where organic remains are abundant.

In the latter case the air penetrating the sand at low tide parts with its oxygen to the decaying matter, and as the tide rises again the residual nitrogen is expelled in bubbles under the pressure of the advancing water, while the carbon dioxide formed is retained in solution.

Gas collected from the gravel bottom of a stream flowing into the Ohio river near Sewickley, Pa., was found to have the following composition:

Methane	93.06 per cent.
Nitrogen	6.70 "
Carbon dioxide	0.24 "
	100.00 per cent.

There is no reason to suppose that the diffusion of gas from the earth into the atmosphere is confined to surfaces covered by water, although it can only be made visible by the formation of bubbles in water.

It is no doubt continually in progress in regions of Devonian and carboniferous rocks.

This slow diffusion of gas from the earth into the atmosphere has occurred since early geological times and in regions where erosion has finally carried away whole systems of sedimentary rocks, liberating the imprisoned hydrocarbons by slow degrees. The gas thus escaping from within the earth's crust is added to that which is derived from recent decay on the surface, and probably forms no inconsiderable part of the total quantity carried continually into the atmosphere.

Hydrogen in a limited volume of air follows the well known law of diffusion, mixing completely with the air.

Should a large mass of hydrogen enter the earth's atmosphere, the case would be different. Hydrogen, while it would diffuse laterally with the air, would tend to accumulate in the upper strata on account of the great difference between its specific gravity and that of the constituents of the air. Ferrel[1] has fully discussed the hypothetical case of the occurrence and arrangement of a very light constituent in the atmosphere. "Where the relative densities of the constituents regarded as independent atmospheres would be nearly the same at the different altitudes, as in the case of oxygen and nitrogen, a constant agitation of the whole may keep them so mixed up that the proportions are nearly the same at all altitudes; but, in the case of a very rare constituent, the tendency would be for it to rise up so far above all the others that it could not become mixed up with them except in the lower strata, and at a considerable altitude it would be the only sensible constituent unaffected by the agitation of the comparatively much denser constituents which would exist, only sensibly lower down, near the earth's surface."

If the presence of hydrogen is ever positively detected in the atmosphere, it must be looked for in air samples collected as far away from the earth's surface as possible.

An experimental demonstration of the presence or absence of hydrogen in air, would be of great interest if the method to be employed were certain as regards its results. Existing methods for the detection or determination of hydrogen when present in traces, are not satisfactory.

After many trials, I have devised a method for the detection of traces of free hydrogen in a gas mixture. The method consists, briefly, in passing the gas over anhydrous palladium chloride contained in a glass tube. Free hydrogen reduces this salt at once, and in the cold, being converted into hydrochloric acid, which is recognized by passage through a silver nitrate solution.

Having in palladium chloride a reagent of extreme delicacy for free hydrogen, it seemed to be of interest to attempt a test for hydrogen in air, and in order to avoid, as far as possible, all danger of impurities from local conditions at the earth's surface, some experiments were tried on Mount Washington, New Hampshire, during August, 1892.

The elevation of Mount Wasnington, nearly 7,000 feet, did not justify the belief that upon its summit strata of air materially different from those at sea level could be reached, but there was the undoubted advantage of greater purity and freedom from local contamination.

1. J. Chem. Soc. (Lond.) 1883, p. 295.
2. Mendeleef: Principles of Chemistry, 1, 365.

1. Annual Report of the Chief Signal Officer of the Army, for 1885, part 2, page 41.

By permission of Mr. Mark Harrington, of the U. S. Agricultural Department, a room in the Weather Observer's building on the mountain was used for the purpose.

I desire here to express my appreciation of the courtesy shown by Mr. Harrington and also by Mr. Mitchell in charge of the station, in affording facilities for the work.

Details of the work are omitted, as the results of two very carefully conducted experiments were negative, and therefore did not lead to a definite conclusion.

It may be suggested that ozone, by reason of its great oxidizing power, would tend to prevent the accumulation of combustible gases in the upper atmosphere. Oxygen is well known to derive its active properties from the influence of the electric discharge.

Ozone may be produced locally in considerable quantity as a result of violent electrical disturbances in the atmosphere. Much of the ozone thus formed probably expends its power in oxidizing atmospheric nitrogen to nitrous and nitric acid.

Ozone has a specific gravity much greater than oxygen, and would, consequently, tend to descend rather than to rise to the outer limits of the atmosphere. While the production of ozone must occur at points remotely distant and at considerable intervals of time, the evolution of hydrogen and methane at the earth's surface is continuous. Moreover, thunderstorms only occur during a brief portion of the year in temperate climates, and are unusual at all times in far northern latitudes.

In view of these facts it seems improbable that ozone can be considered likely to materially retard an accumulation of the lighter gases, hydrogen and methane, in the upper atmosphere.

Hydrogen and methane are not oxidized by prolonged contact with a 2 per cent. solution of hydrogen peroxide at 20° C.

It is true that the upper air may contain nitrous acid. Paper coated with potassium iodide and starch was found to be rapidly turned purple when exposed on Mount Washington. Free hydrogen is however, not oxidized by fuming nitric acid,[1] and it is hardly likely that nitrous acid, in the highly diluted condition in which it must be looked for in air, could cause an oxidation of hydrogen.

Meyer[2] and Askenasy found that on exposure to bright sunlight, a mixture of oxygen and hydrogen suffered no change. Combination did not occur even on exposure of the gas to a temperature of 600° C.

Meyer and Seubert[3] have shown that under highly reduced pressure combination does not occur in a mixture of oxygen and hydrogen under the influence of the electric spark. Experiments with mixtures of various hydrocarbons with oxygen led to similar results. The minimum pressures at which the electric spark caused an explosion were about one-tenth of an atmosphere in the case of hydrogen, and one-sixth of an atmosphere in the case of methane. In earlier times Humphrey Davy was led to similar conclusions as regards the explosion of rarefied gas mixtures.

Although the minimum pressure at which chemical union would occur may vary with the character of the discharge, it may be asserted that electrical disturbances are less likely to influence the oxidation of these combustible gases in the higher atmosphere where they must be looked for, if present in the atmosphere at all.

Methane and hydrogen possess, under all conditions, great resistance toward oxidizing agents, and, once set free in air, it is questionable whether either gas could undergo any change by which it might be wholly brought back within the sphere of reactions produced by organic life, or by oxygen. Ferrel has suggested that the hydrogen of the sun's atmospbere may form merely an outer layer, resting upon much denser gases below.[4] It is possible, at least, that such an arrangement exists in the earth's atmosphere.

It seems desirable that tests for hydrogen and methane in air, should be made at still greater altitudes in order that more definite information may be gained upon this interesting subject, although serious difficulties would be encountered in attempting to reach an altitude so high as to render the results of chemical tests positively conclusive.

1. Winkler: *Ztschr. anal. Chem.*, 1889, 269.
2. *Ann. Chem.* (Liebig), 209, 73.
3. *J. Chem. Soc.*, 1884, 567.
4. *Loc. cit.*

Storage Batteries.

The *Electrical World* notes that a paper on this subject was read at the last meeting of the British Association by a Mr. Earle, and our contemporary also surmises that the author is connected with the company which manufactures the chloride accumulator. The paper was printed in full, with elaborate illustrations, in the English papers devoted to electrical topics, but the following abstract of Mr. Earle's compilation will be sufficient to enable our readers to get at the gist of it.

After giving a brief history of the secondary batteries, the origin of which he dates back to the experiments of Gautherot in 1801, he states that much has recently been done to perfect and cheapen the production of solid lead plates (apparently meaning plates formed by modified Planté processes), and these, he believes, are making such strides that it seems probable that they will eventually outstrip and replace their pasted rivals. Improved methods have been discovered for affecting rapid formation at a reasonable cost. He believes that in all probability there will be little extension of the use of pasted plates.

Aside from the question of cost, he believes the chief points to be considered are chemical action, mechanical construction and proper treatment of the cells when made; he gives the theoretical value of lead peroxide as 4.44 grammes per ampere hour, or roughly, 1 pound per 100 ampere hours; or assuming that the positive and negative plates were identical, it would be 50 ampere hours per pound of peroxide and spongy lead. The highest capacity plates yield only about 7 amperes per pound of positive and negative plates. The larger part of the paper is devoted to the study of the behavior of cells under various conditions. A number of curves for various relations are given and discussed. One set of curves gives the capacities per pound of plate for various rates of discharge in hours for seven different kinds of cells (but the names of these are not given). The capacity rises at first rapidly as the time increases, after which the curves become nearly horizontal. Another set of curves gives the voltage for different rates of discharge of one type of cell (presumably the "chloride").

He calls attention to the conditions that are frequently given in specifications for storage batteries. In some cases a fall of voltage not exceeding 8, 10 or 12 per cent. is allowed, at a certain rate of discharge, but this, he says, is in most cases unsatisfactory, on account of the doubt as to what should be taken as the starting point on which this percentage fall should be based. Another set of curves gives the fall of the open circuit voltage for 21 hours after the completion of the charge, a curve being given for each different strength of acid. These curves fall gradually, and the voltages are considerably higher the greater the specific gravity; if the fall of voltage is limited, therefore, it would be advantageous to the manufacturer, but not to the purchaser, to allow the battery to stand for a few hours to reduce this first voltage. The best way to meet the point is to take, as the first reading, the voltage 5 or 10 minutes after the discharge began. Specifications generally necessitate a much larger battery than was intended, with corresponding increased cost. The manufacturer may find that the buyer is not satisfied with even a 50 per cent. excess in ampere hours, but will require to have the volts as well. The most satisfactory way to frame a specification is to specify the exact capacity in ampere hours and the final voltage of the complete battery at a given rate, the number of cells to do this being left to the manufacturer. A low voltage per cell enables the number of plates per cell to be reduced, and the cost as well, and in a competitive tender the manufacturer would therefore work out the cheapest arrangement. The actual number of accumulator cells when discharged down to 1.8 instead of 1.9 is only two cells in a 100-volt battery. He shows that no reliance can be placed on the efficiency and capacity determined from a single charge or discharge, as no two consecutive discharges as a rule are identical, each one being influenced by the previous treatment. This is shown by a table giving the first 10 charges and discharges of a new cell which shows the irregular nature of the results obtained, with slight variations in time and maximum voltage of charge. If worked within reasonable limits an efficiency of 90 per cent. in ampere hours and about 80 per cent. in watt hours can be obtained when the cell is in good order, but usually the efficiency is of no great importance in central station work, except when the battery supplies the whole demand of the station. He shows the great importance of the strength of the acid, giving the curves showing the great influence on the voltage; it also has a great effect on the life, strong acid sulphates the plates more readily, and they are more difficult to reduce.

The resistance of the acid is also important. Curves are given showing the specific resistance at different strengths and temperatures. Acid of a specific gravity of 1,250 has the least resistance, but this does not give the highest voltage, and it has the disadvantage that during the discharge the gravity diminishes, and therefore the resistance increases while the voltage also falls. Different specific gravities also give different capacities, as shown in an interesting curve giving the capacities per pound of active material for different specific gravities at the end of the discharge and corresponding curves for the voltage. They were taken for two chloride cells, one with thin and the other with thick

plates, both being discharged at 0.45 amperes per pound of plate. The rate per pound of active material is nearly the same for both, but the rate per area is approximately 40 per cent. greater with thick plates The curves for the thin plates show that with acid of 1.070 only about 3 per cent. of the maximum capacity is obtained; the maximum is obtained at 1.230; each 1 per cent. addition in the sulphuric acid gives an increase of about 1 ampere hour capacity per pound of peroxide. After the maximum point the curve falls about as rapidly as it rose. For the thick plates at 1.040, the capacity is about 6 per cent. of the maximum which latter is reached at 1.270, after which it falls rapidly. The thin plates give a maximum of 15 ampere hours per pound of peroxide and spongy lead, or about one-third of the theoretical value, while the thick plates give only 10 ampere hours.

He discusses the reasons for this and why the thick plates are best with weak acid, while they are much poorer with the acid usually used. The capacity is practically reduced inversely as the thickness. The voltage curves rise almost steadily with the increase in the strength of the acid. For the same rate of discharge an increase in ampere hours per pound of material means a longer time to complete the discharge, and the greater the length of discharge the higher the mean voltage. He shows the important effect on the life of the cell, of the treatment which it receives after it leaves the manufacturer. Purity in the electrolyte is essential. Brimstone acid should be used and it should be diluted with pure water, preferably rain or condensed water. Fully formed plates are very slightly affected if the first charge does not immediately follow the filling of the cells with acid. Another set of curves shows the effects of leaving the plates standing in acid or of charging them. They show how very slight differences can cause considerable variations.

The chief causes of destruction are too prolonged or excessive rates of discharge, insufficient charging, overcharging, long periods of rest on open circuit without charging or after complete discharging. A frequent mistake is made in adding acid because the specific gravity has fallen, due to heavy sulphating. Instead of adding acid the cells should be given a prolonged charge. The chief thing to be prevented is disintegration. In conclusion, he states that considerable study is required, as the results of tests are often conflicting, and depend on very small differences in the conditions.

The Storage Cell from a Point of Economy.

By Mr. Meyer Cushner.

In the age in which we now exist no question appeals more strongly to man than that of money. The artist, musician, actor and inventor rarely work for the advancement of their art, but for money. This fact alone, perhaps, has added more to the list of inventions, paintings, operas, and also to the number of inventors, painters and artists, than could ever have been hoped in this century.

We are apt to come to the conclusion that the experiments that have resulted in a new chloride battery were not made, like Faraday's experiments, purely for science, but for money. Economy tempted Faure to make his improvement on the Plante cell, and it was economy again that produced the chloride cell which is showing itself to be of vast commercial importance.

The electrical engineers of this period are never satisfied with one invention until it has been brought as near to perfection as their fertile minds can make it. Every slight defect must be remedied, and the constant perseverance with which they work is the one great reason for the latest development in storage batteries.

Gaston Plante invented a storage cell in which he was enabled to store up electricity for future use by a forming process which is very expensive; but economy and Faure's active brain show to the world that the forming process was unnecessary; that the active materials, red lead and litharge, may be substituted.

Men, seeing the economical point readily gained, invested their money in this venture, for common sense has clearly shown that, by means of the storage cell, science, the world, the capitalist himself, would be benefited and made more wealthy by the modern chloride storage cell than by the older method.

Since it is conceded that this cell has come into use and is generally popular, either commercial or scientific reasoning must answer the question why and how it has received recognition. When a company is organized it is for the purpose of gain, and if the storage system did not have any advantages over the others, if it had not proven itself more convenient, we can scarcely believe that so much investigation and trouble would have been taken for nothing.

Answering the question from both the commercial and the economical point of view, it can truly be said that the chloride cell is the best of any yet invented. Its advantage lies in the fact that the active substance is cast with the leaden plates, and is therefore less liable to fall and cause short circuits in the battery, for "the active material is obtained, not as in the old way, by cementing lead oxide paste into a frame, but in a manner purely chemical."

A combination of chloride of lead and zinc in certain proportions is fused and cast into pastilles, which are then placed into suitable molds. Molten lead is then cast around them under high pressure, thus insuring good contact between the active surface and inclosing frame. This is a great point gained in electro economics, as most of the money formerly spent was wasted in a method of obtaining good, solid contact, and for keeping the activities of the cell in position, so that the slightest jostling would in no way affect them. From the commercial view, therefore, we have a storage cell of great durability, which promises well for the future.

From the electrical side we derive greater advantages, as the chloride cell has greater efficiency. In a recent test at the electrical laboratory, by my partner, of the chloride and the pasted forms, the storage cel's were compared, and the comparison showed that by treating the two in the same manner one was by far the better. The curve of discharge indicated that for the 55 ampere hours put in, we obtained more current from the chloride than the Faure cell. The efficiency of each cell was then determined, and the former showed itself the better.

This fact alone should raise the cell to a higher plane in the esteem of electricians. We use the mechanical power of the steam engine to generate the electrical power, which, passing through the cell, produces chemical action, and thus, from the electrical power expended, we obtain more current, consequently more work.

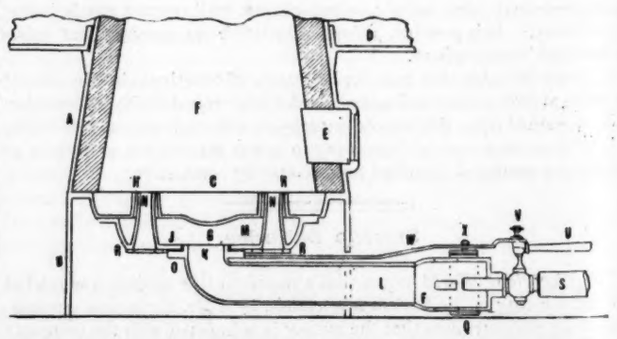
In the use of the storage battery in electric generating stations for regulating the power, it is known that, owing to the fluctuations and variations, it is necessary to employ generating machinery of greater capacity than would be necessary if it were operated at a regular load. Ten to 15 per cent. more steam is necessary for the larger engines in order to overcome the load. The storage cell and the dynamo, however, may be made to work together, the one always balancing the other.

An Atmospheric Gas Burner.

Protection by English Letters Patent (No. 21,348) have been issued to Mr. R. N. Oakman, Jr., of Greenfield, Mass., through Mr. H. E. Newton, of London, England, for an atmospheric gas burner. Quoting freely from the specification:

The object of this invention is to provide a burner which is simple in construction and entirely safe and effective in operation; and one of the special objects is to provide for simultaneously controlling the supply of gas and the primary supply of air to the mixing tube and chamber, and also controlling the secondary supply of air to the burner nozzles, by means of a suitably connected gas valve, and a sleeve and damper for the air supply. Provision is also made for better mixing the gas and air for causing complete combustion at the burner nozzle, by admitting the air centrally through an opening surrounded by a ring of inflowing gas.

The accompanying drawing represents a vertical section of the base of the furnace and of the gas burner.



The burner is preferably used as a furnace *A*, which contains the firebox, and having a downward extension *B* of the iron shell, to form an air chamber and hold the burner *C*. The shell of the chamber for outgoing products of combustion connects with the furnace *A*, as indicated at *D*. The iron shell of the furnace *A* is provided, near its bottom, with

an inwardly projecting annular flange, or with lugs which support the lining of fireclay or other non-conducting material. A lighting opening *E*, having a door, is formed in the wall of the furnace *A*, for giving convenient access to the burner.

The burner *C* is preferably made of circular form, and of sufficiently large diameter to completely fill the horizontal area of the combustion chamber *F*, and projects at its edges beyond the interior surface of the lining, and fits closely against the lining and the annular flange on the metal shell, so that no air can pass into the combustion furnace around its edges. The burner is constructed with a dished or upwardly flanged top plate *G*, having inwardly turned edges, as shown, and also having a circle of tubular openings *H*, which are preferably tapered from below upward. The space between the upwardly turned flange and around the tubular openings or nozzle *H* is filled in with asbestos mortar, or other non-conducting material, for protecting the metallic tubes or nozzles from injury by heat.

A dished hollow bottom plate *J* is secured by bolts to the under side of the top plate *G*, and is provided with a central opening *K*, at which place there is connected the gas and air mixing and supply pipe *L*. The hollow plate *J* forms, with the top plate *G*, the gas and air chamber *M*, and it is constructed with a circle of tapering tubular openings or nozzles *N*, open at their upper and lower ends, and projecting into the tubular nozzles *H* of the top plate. The annular nozzles *H* serve for the admission of air to support combustion of the gas in the combustion chamber *F* of the furnace.

The gas and air mixing and supply pipe *L* is provided at its inner upturned end with an annular flange *O*, which is secured by screw bolts or rivets to the bottom plate *J*, and said pipe is provided at its outer end with an enlargement *P*, having a circle of elongated openings or ports for the admission of air to be mixed with the gas. A sleeve or collar *Q* is arranged to slide and turn upon the pipe so as to control the air inlet openings. An annular disc valve or damper *R*, having a circle of suitable openings, is loosely supported in contact with the under side of the bottom plate *J* by means of headed screws, and is also guided by pins, so that said damper is free to rotate in contact with the plate *J*, and thereby control the admission of air to the nozzles *N*. The openings in the damper *R* are so spaced as to register with the air nozzles, and are of such a distance apart as to permit the nozzles to be completely closed by the damper.

The gas supply pipe *S* is provided with a plug valve and with a screw-threaded extension or nozzle, which projects into the rear end of the pipe *L*, with its inner end adjacent to the air ports. The stem of the plug valve is provided with a lever handle *U*, and an arm at right angles to the handle *U*, or at any desired angle thereto; and the outer end of said arm is pivotally connected by means of the thumbscrew *V* to the outer end of the rod *W*, which is connected to the sleeve or collar *Q* by means of a screw or pin *X*, and to the damper *R* by means of a screw or pin. The connections at the pins are loose, so as to provide perfect freedom of movement to the collar *Q* and the damper *R*.

It will thus be seen that the gas supply valve *S* and the air inlet ports are simultaneously controlled by one lever, and by a single movement thereof; whereby complete combustion of the gas is always insured, and at the same time lighting back is prevented. The secondary air supply by the nozzles *N* to the burner nozzles *H* is also controlled by the same lever handle *U* and connecting rod *W*, so that perfect control is had of the gas supply, the primary air supply for mixing with the gas, and the secondary air supply for causing complete combustion at the burner nozzles; thereby insuring entire safety, economy in the use of gas, and also entirely satisfactory results in the combustion of the gas, and in the heating effects thereof.

It has been found quite advantageons in practice to admit air centrally through an opening or nozzle surrounded by an annular supply of inflowing gas, as in the improved burner.

Data for the Ascertainment of the True Atomic Weight of Carbon.

[By Prof. J. Alfred Wanklyn, before the Ipswich Meeting of the British Association.]

In December, 1893, I wrote in the *Philosophical Magazine:*

"An investigation which has occupied me for the greater part of the year has yielded the following result. There is a series of hydrocarbons, the successive members of which rise in molecular weight—not by CH_2 = 14—but by ½ (CH_2)= 7. If this result cannot be overturned, the consequence follows that the atomic weight of carbon is 6."

The series concerning which I wrote at the close of the year 1893 was the hydrocarbons existing in Russian kerosene imported into this country. That series would, according to the prevailing knowledge of the day, be termed a series which was only imperfectly understood. Continuing our work, my colleague Cooper and myself have recently published[1] a parallel investigation with a parallel result, given by a series of hydrocarbons which the knowledge of the day pronounces to be comparatively well explored and well understood. The series is the marsh gas series, which is now regarded as the backbone of organic chemistry.

The paper published last month in the *Philosophical Magazine* contains a concise statement of our work, and we proceed to quote from it as follows:

The first term of the marsh gas series which figures in our table is the 15th member of that series. In an admirable paper of Schorlemmer's, published in the *Journal of the Chemical Society* for the year 1863, a liquid is described under the name of hydride of heptyl, which we believed contained at least 50 per cent. of our Marsh xv. (formula $C_{15}H_{17}$). Quoting from that paper, we find that a combustion of the liquid gave 83.93 per cent. of carbon, 16.13 per cent. of hydrogen, and the determination of vapor density 3.59, which is a figure between that required for hydride of heptyl and our Marsh xv., and which, indeed, approaches nearer to that required by Marsh xv. than to the figures required by hydride of heptyl.

The figures are theoretical V.D. of Marsh xv. = 3.697; theoretical V.D. of heptyl hydride 3.455. Obviously, therefore, the figure obtained by Schorlemmer, 3.59, agrees better with our view than with that held by himself 30 years ago.

As I hold that the only datum given in Schorlemmer's paper which is valid as a piece of evidence capable of deciding between the two formulæ is the V.D. determination, I hope I may be pardoned for going over Schorlemmer's calculations, the correctness of which I am able to confirm. I make, however, this note, there is no mention made of the size of the inevitable air bubble in the Dumas determination, and if we suppose that this air bubble was of the usual size when the workmanship is excellent (as Schorlemmer's workmanship always was), the correction for the air bubble would bring Schorlemmer's figures very close to Marsh xv.

A consideration of all the circumstances of the case leads me, indeed, to the belief that Schorlemmer's hydride of heptyl of the year 1863 consisted mainly of Marsh xv., mixed with hydride of heptyl.

The main body of Schorlemmer's paper, which I am at present quoting, is occupied with an account of the chlorination of the hydrocarbon and the various derivatives of one of the products of the chlorination. It is an admirable piece of chemical workmanship, and deserves proper appreciation.

There are two classes of reaction in organic chemistry, viz., the complete and the incomplete.

Chlorination of such a body as Marsh xv., or heptyl hydride, is notoriously an incomplete reaction. This fact becomes very apparent in Schorlemmer's account of the operation. It is impossible to take a quantity of the hydrocarbon and transform the whole of it, or anything like the whole of it, into a monochloride. Only a portion of the hydrocarbon undergoes chlorination in this operation, and the "unattached hydride," as Schorlemmer says, was distilled off after the termination of the chlorination. The monochloride was then separated by fractional distillation from the accompanying dichloride, and from the still more highly chlorinated products which are the inevitable companions of the monochloride as yielded by the process of chlorinating a hydrocarbon. The monochloride (which is described as a liquid boiling at 150°) does not appear to have been submitted to analysis, but was employed in the preparation of the acetic ether by reaction upon acetate of potash. Great difficulty was experienced in pushing the reaction to completeness, and, furthermore, only a portion of the monochloride underwent transformation into the acetic ether. The olefine heptylene, as well as acetate of heptyl, are described by Schorlemmer as arising from the reaction upon acetate of potash.

The acetate of heptyl described by Schorlemmer was therefore derived from the original hydrocarbon by two incomplete reactions, and is not a fair representative of the whole of the original hydrocarbon. The acetate was analyzed, and its analysis agreed with the formula for acetate of heptyl. It was also converted into the corresponding alcohol by a process which is known to be complete when applied to the acetate. The alcohol was also converted in a thoroughly satisfactory manner into the iodide, and both alcohol and iodide were analyzed with good results, the iodide especially being beautifully in agreement with the theory. When these results are fairly considered they indicate the probability that some portion of the original hydrocarbon consisted of

1. Vide *Philosophical Magazine*, August, 1895.

that heptyl-hydride, but they afford no ground for the conclusion that the whole or even the greater proportion of it consisted of that hydride. There is a curious piece of evidence pointing in the other direction. The olefine (which accompanies the acetate of heptyl) was investigated. It was sealed up with hydriodic acid and heated to the boiling point of water for 12 hours and converted into an iodine compound, which on analysis was found to contain only 55.73 per cent. of iodine instead of 56.19 required by the iodide of the heptyl series.

The circumstance that the other iodide gave almost exactly the theoretical result, viz., 56.18 per cent. of iodine, lends importance to this discrepancy, which Schorlemmer does not in any way explain.

A by no means unlikely explanation of the discrepancy is that the iodine compound was a mixture of the derivative from our Marsh xv. with the derivative from hexyl hydride.

In criticising this work of Schorlemmer's nothing is further from my intention than to belittle it. A very important general fact is established by it and by the researches of Cahours and Pelouze and Carius. The fact is, that one atom of hydrogen in the marsh gas series of hydrocarbons is replaceable by chlorine, which in its turn suffers replacement by other radicals so as to yield the alcohol, the mercaptan, and the various ethers. Until, however, the chlorination process has been much improved it cannot be valid as a method of distinguishing between heptyl hydride and the 15th term of the marsh gas series.

In due time we expect to exhibit the intermediate alcohols and their various derivatives, but at present we have no intention of taking in hand this branch of the investigation. We are at present engaged with the physical side of the subject, and with only such chemical changes as do not involve the destruction of the hydrocarbons.

Inasmuch as the process by which we have been able to separate the hydrocarbons from one another is fractional distillation, we have applied ourselves to the task of measuring the vapor tension of the individual hydrocarbons at different temperatures.

Every chemist knows that the everyday operation of taking the boiling point of a liquid is in point of fact a special vapor tension observation, and that the boiling point is another name for that point of temperature at which the tension of the vapor of the liquid is equal to 760 millimeters of mercury, the average pressure of the atmosphere. Instead, therefore, of using a distillatory apparatus and observing the temperature registered by the thermometer immersed in the vapor of the liquid during distillation, we might arrive at the same result by the employment of the apparatus for measuring the tension of the vapors evolved by liquids at different temperatures.

The apparatus which we employ we have ourselves constructed, and one of its peculiar advantages is that by its aid we are able to ascertain the boiling point of a very minute quantity of liquid. A single decigramme of a specimen of liquid is amply sufficient for such determinations.

Our work in this direction is only just at the commencement, and this map of vapor tensions is a preliminary chart exhibiting part of the curve of tension of 11 consecutive terms of the kerose series.

The tensiometer, as we name our new instrument, has a future rich in promises. In carrying out the fractionation of a mixture of liquids boiling very together, it provides a criterion indicative of the completion of the fractionating process. When the distillation has been pushed to complete dryness there will always be a few drops of residual liquid on allowing the retort to cool. When the tension of those few drops approximates to the tension of the original liquid—that is a sign that the fractionation has reached completeness, and the tensiometer enables that comparison to be made.

Light on the question whether, in a given instance, there is a specific adhesion between the constituents of a mixture may be looked for by having recourse to this instrument, which imparts a degree of certainty and completeness to the fundamental operation of fractional distillation which has hitherto been altogether wanting. In conclusion I exhibit four terms of the marsh gas series, viz.:

Marsh xi	formula	$C_{11}H_{19}$
Marsh xv	"	$C_{15}H_{17}$
Marsh xvi	"	$C_{16}H_{19}$
Marsh xvii	"	$C_{17}H_{19}$

In presence of these substances chemists will be compelled to revert to that atomic weight of carbon which was all but universally admitted 40 years ago.

Under the rated valuation adopted by the Board of Assessors, of Brookline, Mass., the Brookline Gas Light Company paid this year, for the purposes of local taxation, the sum of $4,164.

ABSTRACT OF PROCEEDINGS, TWENTY-THIRD ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

Held at Continental Hotel, Phila., Pa., Oct. 16, 17 and 18, 1895.

The Twenty-third Annual Meeting of the American Gas Light Association was held at the Continental Hotel, Philadelphia, Pa., beginning Wednesday, Oct. 16, 1895. President Walton Clark called the Association to order promptly at 10 o'clock A.M. On motion of Mr. Butterworth the reading of the minutes of the last meeting was dispensed with. The use of an improved card system at the door dispensed with the necessity of calling the roll.

The Council reported favorably upon the following applications for membership, and they were duly elected:

Active Members.

Barrett, W. E., Supt. & Sec. Lower Merion Gas Co., Ardmore, Pa.; Britton, John A., Sec. & Treas. Oakland Gas Lt. and Heat Co., Oakland, Cal.; Burke, Jas. E., Treas. Princeton Gas Lt. Co., Princeton, N. J.; Eilbeck, A. B., Con. Engr. Peoples Gas Co., Harrisburg, Pa.; Elliott, W. P., Con. Engr. Equity Gas Lt. Co., New York, N. Y.; Faux, J. A., Supt. South Side Gas Co., Pittsburgh, Pa.; Ferrier, Jas., Supt. Gas Lt. Co. of Columbus, Ga.; Forstall, Walton, Engr. of Mains, East River Gas Co., New York, N. Y.; Jenks, Zeuner M., Supt. Woonsocket (R. I.) Gas Co.; Lynch, Eugene T., Prest. Detroit (Mich.) Gas Co.; McIlhenny, John D., Prest. Citizens Gas and Fuel Co., Terre Haute, Ind.; Morton, Fred. W., Supt. Lockport (N. Y.) Gas and Elec. Lt. Co.; Nix, Joshua J., Supt. Spring City Gas Lt. Co., Royersford, Pa.; Rice, Harry L, Supt. of Distribution, Milwaukee (Wis.) Gas Lt. Co.; Rogers, W. H., Agt. U. G. I. Co., for Paterson and Peoples Gas Lt. Cos., Paterson, N. J.; Stirzel, J. W., Asst. Supt. Phila. (Pa.) Gas Imp. Co.; Stroud, Morris W., Sec. & Treas. American Gas Co., Phila., Pa.; Thwing, O. O., Supt. of Works, Milwaukee (Wis.) Gas Lt. Co.

Associate Members.

Mordue, Thos. N., Cannel Coal Merchant, New York, N. Y.; Starr, Geo. W., Sec. Yale Gas Stove Co., New Haven, Conn.; Wharton, Henry, Salesman, Westmoreland Coal Co., Phila., Pa.; Woods, Sam'l, Sec. & Treas. Gas Engineering Co., Pittsburgh, Pa.

The following were appointed by the Council as a Committee to Nominate Officers for the ensuing year: C. F. Collins (Chairman), E. C. Jones, James Somerville, Frederic Egner and F. C. Sherman.

The Council approved the reading of the following list of papers:

"The Creation of a Healthy Public Sentiment Toward the Gas Company in the Locality in which it Operates," by Mr. W. H. Rogers, Paterson, N. J.

"Retort House Design and Practice," by Mr. A. E. Forstall, Newark, N. J.

"Notes on the Storage of Oil at Gas Works," by Mr. Frederic Egner, Norfolk, Va.

"The Ventilation of Gas Lighted Rooms," by Mr. Irvin Butterworth, Columbus, O.

"Bench Firing with Soft Coal," by Mr. E. G. Pratt, Des Moines, Ia.

"The Commercial Value of Photometry," by Mr. Alex. C. Humphreys, New York City.

The Council also approved of the action of the President and Secretary in arranging for an illustrated lecture on Acetylene, to be given before the Association by Mr. William W. Goodwin.

The Council recommended that the price of a single copy of the *Quarterly* be fixed at $1, and that the Secretary have printed and furnish to each writer of a paper a dozen extra copies of his paper and of the discussion thereon, and also recommended that any member may purchase four extra copies of any one issue of the *Quarterly*.

Seventeen members of the Association were dropped from the roll on account of non-payment of dues.

The reports of the Secretary, Treasurer and Finance Committee were read and approved.

As the Nominating Committee were unable to present their report (only two members of the Committee being present), the report was postponed until later.

President Clark then read the following

INAUGURAL ADDRESS.

Gentlemen—For the first time since the incumbency of my honored predecessor, General Roome, a President of the American Gas Light Association has the pleasure of welcoming the Association to the city

of his residence. It is my hope that this meeting will justify the action of your committee in yielding to my request that it be held in Philadelphia.

As I understand it, the duty of your President is to address you upon such topics as, to his mind, may most profitably engage your attention as an Association, and to comment fairly and freely upon the affairs of your Association. And this the more if fairness and freedom lead him to speak a word of warning, or point out what appears to him a road to higher efficiency. If upon these matters his thought is in any degree more valuable than that of any one of the men he addresses, it is because the honor of his position and the desire to justify your selection of its incumbent compels him to give them more careful consideration than they ordinarily receive.

The President having discharged his duty in this particular, it becomes the duty of the Association to consider his utterances and adopt or reject his recommendations as in its wisdom it may deem most advantageous to itself.

The temptation to review the twelve months' history of our industry and to comment upon its condition to-day, the greater because the passing year is in general the most prosperous known to the interests we represent, and the future of artificial illumination more evidently secure to us than ever before, I shall put aside. It is not of the gas industry, but of the American Gas Light Association, that, with your kind indulgence, I shall speak to you to-day.

It is said of governments that they are as good as the governed deserve. A similar statement may, with complete truth, be made of purely voluntary associations of men. They are as good as the associated deserve, for they are what the associated make them. If, then, the American Gas Light Association fails of attainment to the high standard set by its founders and desired by its friends, we have not to look for the cause beyond the rules we have established for its government, and the energy with which we apply ourselves to the furtherance of its declared aims. Believing that the efficiency of the Association is far below the expectations of its founders and the desires of its friends, my sense of obligation for the honor it has given me and the good I have had from it, compels me to a discussion of its condition and to respectful suggestions of a way to its improvement.

The chief function of the Association is educational. It is through the formal papers and their discussions that most of the good it is now doing comes to the individual member and to others who may read our proceedings. Upon the character of the papers presented for its consideration the American Association is to be congratulated. Many of the very highest order have formed a part of its record. The discussions have not, in my judgment, been worthy of the papers, and this for several reasons.

The men who discuss papers are few in number. With a membership approximating 400, there were in the three years covered by the last volume of proceedings but 81 speakers. Only 20 per cent. of the membership taking any part in the literary proceedings in three years! Of these 81 speakers but 34 took part in the discussion of three subjects. But 8 per cent. of the Association discussing an average of one subject a year!

A writer of a paper, preparing it at his comparative leisure, with his books and records at hand, can cover that part of the general field of our industry that he has selected for his subject; and the sense of responsibility that comes from his position as a paper writer, as well as a desire to add to, or maintain his own reputation, insures a serious attempt at thoroughness.

The interest of truth demands a thorough discussion of every paper that finds a place upon our records, and a thorough oral discussion cannot be had without the participation of more speakers than now take part. The discusser has not the sense of responsibility, nor the stimulus of personal interest in the same degree as has the paper writer. Ordinarily, he comments upon a portion of the paper, and superficially. To satisfactory work more discussers are necessary. There must be a reason for our having so few. I believe two causes are operating against us. First, the lack of opportunity for studying the paper to be discussed. An effort has been made during the past two years to get copies of the papers into the hands of members some weeks or months in advance of the meeting, through the medium of the quarterly publication. It has achieved but a very partial success. This year its success may be described as failure. The main reason has been the failure of writers to send their productions to the Secretary in time to permit their early publication. I do not know that anything can be done to insure the earlier preparation of papers. To most of our membership the interests of the Association are, necessarily, subordinate to other interests, and must take their chances accordingly.

I suggest, as a partial remedy for the present unsatisfactory condition, the abolition of the *Quarterly*, and a resolution instructing the Secretary to print and mail to each member a copy of each paper as soon as received and approved by the President and himself; and to present for discussion only such papers as are in the hands of members at least two weeks prior to the date of meeting. As a successor to the *Quarterly*, I recommend the publication, as soon after the meeting as possible, of an annual volume containing the proceedings of the Association. I would recommend the retention of all laws now in force relative to the publication of the proceedings in other than the official volume.

The second cause of incomplete discussions is—hurry. We have so far gone on the, to my mind, false theory that the greatest good comes from the reading of all the papers presented, whether or not time is left for discussion. It is my belief that the discussion of a paper should not be cut to leave time for the reading of another; that one paper thoroughly discussed is of more value to us than many papers without discussion, and I recommend to you a modification of our practice in this regard.

Another subhead of the educational function of the Association is systematic investigation of processes, apparatus, etc., for and by the Association. I do not think the American Gas Light Association is ready for any departure in this direction. Not before we have a larger revenue, and a secretary who is paid to devote his entire time to the work of the Association, will such an innovation be possible. I leave to a future President the making of an affirmative recommendation in this matter.

In further discussion of the educational function we come to the inquiry—what effort is the Association making toward giving systematic aid to the many boys, and men, who, without the advantage of an advanced education, are struggling to fit themselves for positions of responsibility, while filling subordinate positions in our gas works. The answer must be "Nothing." I respectfully submit that the Association is failing of its duty in this matter. There are no gas text books, as far as I am aware, the only authority attempting the work of setting problems to tax the ingenuity of the gas student is the London Guild. Its work, while admirable, is insufficient to meet the occasion. The field is broad, the work worthy the best effort of the Association. Its cost in money would be small. Its value to the industry and to the youth engaged in it may best be estimated by those of us who have worked our way up from the ditch, or the bench, without the advantage of a previously obtained education.

I recommend to you a standing committee on education, to be composed of the junior past President, the First Vice President and the Secretary of the Association. The personnel of such a committee would change slowly, giving some assurance of system and continuity. A list of problems formulated by the committee, and printed in the annual publication, would be of great assistance to the student, extend the influence of the Association, and increase the value of its proceedings. I recommend the establishment of two prizes, in books, for the best and second best answers to the questions. I think the questions should be graded, and the prize answers, with the committee's comments, published in the annual volume. If the recommendation meets your approval, its details will be worked up by the Committee on Education, when created.

An Association jealous of its reputation will be jealous of its membership. It will strive to include all elements of strength and exclude all others. I respectfully suggest that our constitution does not sufficiently protect the Association in this regard. Any man occupying one of several described positions in a gas company is eligible for membership, however unfit he may be to aid in the declared work of the Association; and no man, however competent, can give us his help unless he holds one of these positions. I know men in the gas business thoroughly competent to aid the Association in its work, who can only acquire membership by accepting temporarily some position that will make them eligible; and the Association has honored with a high office one man not at the time technically eligible for active membership under the constitution. I believe the practice in engineering bodies generally, of making membership depend upon ability and record, and not upon present official position, is better than our plan, and I recommend a constitutional amendment to that effect.

About six years ago Mr. C. J. R. Humphreys read, before the Society of Gas Lighting, a paper whose title might reasonably have been "United Action Among Gas Associations." In 1892 Mr. W. R. Addicks read before you a paper upon "A Gas Association and Its Members." The apparent purpose of these writers was the same—the federation of all American gas engineering societies, to the end that united action

might give better results. In Mr. Humphreys' mind the value of concert in investigation appears to have been the prevailing thought. Mr. Addicks' opening paragraph indicates the immediate cause of his paper —his appreciation of the value of standards, and the hope that the federation of the various Associations would lead to a more general standardization of apparatus. Neither of the gentlemen limited the value of federation to what appears to have been his moving thought.

I have no argument to offer for or against federation. Wisely or otherwise, you determined its fate at your last meeting. My hope is to now point out a course that shall give the American Gas Light Association the benefits that should follow federation without the uncertainty that must accompany a radical change in organization. The American Association is co-extensive with the country. It covers every degree of latitude and longitude that would be covered by the proposed federation. The stronger men of the minor Associations are, almost without exception, among its members. I believe that the name of every man who has been a President or Secretary of the Western, Ohio or New England Associations, or the Society of Gas Lighting, is on the roll of the American. We can command the experience and ability of the nation. Let us devise and operate the necessary system, and, as I believe, all that federation would make possible may be, and more expeditiously, accomplished under our present organization.

I recommend to you the creation of a special committee on standards, to be composed of the Secretary, First Vice-President and one member to be appointed by the President, with instructions to report at the 1896 meeting what, if any, additions should be made to the list of standardized appliances, with such details and recommendations as they may think it wise to make. There is little apparatus that can advantageously be standardized. Aside from standard systems of recording and reporting, connections offer, I believe, the only field—and they are now mostly standardized. The house piping standards are in need of attention. The present generally accepted rules have proven decidedly misleading.

I further recommend the creation of a Standing Committee on Research, to be composed of three Vice-Presidents, the Secretary, three members, to be elected three the first year, for terms of one, two and three years, respectively, and thereafter one each year for a term of three years, the President to be ex-officio Chairman. I do not believe in the Association undertaking any extended investigation on its own account, for reasons already given ; but we must have original investigation if we are to have progress.

Self-interest is the important factor in the work of the world. A sufficient inducement should insure to the American Association, as it has to other scientific bodies, the preparation of reports upon original investigation that will add to the value of its proceedings and membership. I suggest that the Commitiee, if formed, be authorized to offer a biennial prize of a life membership in the Association, and a suitable decoration, for the most valuable contribution based upon original investigation, if either of the contributions submitted is, in the judgment of the Committee, of sufficient value to merit the honor. Such a prize should stimulate the ambition of the best of our membership. It would be unique, and the honor of its possession would amply reward the labor of its attainment.

Its cost to the Association would be insignificant. The committee might reasonably decide to nominate the subject of the investigation. I believe the two committees could do for the gas industry and for the American Gas Association all that could be accomplished by any plan so far proposed. What they will do, if formed, will depend upon the support given them. Associations, as individuals, obtain of success the least they are content to receive.

Gentlemen, the American Association has been the subject of severe, and not always unmerited, criticism. The criticisms that have hurt me most have come from members, men who were anxious that the Association should be a credit to itself and to the great American gas industry. The Association is said to be stagnating, and men within the sound of my voice have seriously discussed the wisdom of deserting it and forming another on broader lines. The American Gas Light Association is not to be disrupted save by its own consent ; but it cannot afford to ignore the fact that some of the strongest members are dissatisfied with it, and that many of the best minds in our business take no part in our proceedings. Protestations are in vain. Our only course is to make membership so valuable that no ambitious American gas man will be content without it. Thus will we justify our Association and add to the benefits we and our industry may receive from it. In the hope of furthering this end, I have recommended to you such changes in our practice as I believe may advantageously be made, at small expense, and without risk.

The necrology of the Association for the past year is sadly long. Ten members have died since we met in Washington.

Samuel G. Stiness, died November 5th, 1894 ; Thomas D. Gilbert, died November 18th, 1894 ; George H. Wells, died November 22d, 1894; Thomas C. Cornell, died December 29th, 1894 ; Sylvanus S. Townsend, died January 14th, 1895 ; James McCutcheon, died———; Oscar Zollikoffer, died April 7th, 1895 ; Augustus P. Collins, died April 21st, 1895 ; William C. Adams, died May 19th, 1895 ; Charles A. Bennett, Jr., died July 24th, 1895.

The unusual circumstance of a death among the officers of this Association justifies my indulging the desire to say a few words of Mr. Stiness. In his death the Association has lost a loyal and useful member. His contributions to the literary exercises have been numerous and valuable, and at the social functions his ringing voice and ready speech added always to the enjoyment of his associates. The tragic circumstances attending his death are known to you. We who knew him may be sure that in the last awful moment, as his physical being strove to escape the impending doom, his spirit looked his fate calmly in the face, and that he died as becomes a man.

I thank you for your attention and for the honor of this office. It is my ambition to merit your confidence, and to be a worthy successor of the able men who have in past years presided over your deliberations.

The President's address was referred to the following Committee : E. McMillin, A. C. Humphreys and James Somerville.

[To be Continued.]

High Silica Firebrick.

By Mr. Charles Terry, Troy, N. Y., in *Iron Age*.

It has become a well established fact among iron makers and firebrick manufacturers who have investigated the subject that it is practically impossible to produce a single brand of firebrick which will give superior results in every class of furnace work. In other words, a certain grade of firebrick may last exceptionally well in the air furnace of malleable iron works, but when placed in the neck or flue of a reheating furnace will melt down in a comparatively short period of time. These experiences in practice have proven to the firebrick manufacturers that in order to adequately meet the requirements of an extensive trade they must place upon the market several different grades of firebrick. These manufacturers, as a rule, have little knowledge of the composition or peculiar physical character of their finished product or raw material, hence have really no basis to work upon for perfecting mixtures of any desired chemical combinations. If these various grades of firebrick which have proven themselves to be suited each to special conditions of furnace work are analyzed, it will be found that their compositions differ a good deal.

The physical structure as a result of the state of the raw clay or treatment in its manufacture may have a little bearing upon the actual service which the different brands give, but experimental work in this line proves conclusively that the most reliable index of their applicability to any given conditions is found in their chemical composition.

Among these numerous varieties of firebrick we find one commonly called a high silica firebrick, which for certain purposes gives extremely favorable results. These should contain a very large excess of anhydrous silica, this being its principal feature and from which the brick derives its name. While they have proven themselves especially efficient, and perhaps more so than any other variety of firebrick in places to which their chemical and physical nature is adapted, they have too often failed to demonstrate their superiority over other grades of refractory brick. Perhaps this may be due to inferior quality, or to poor judgment in their application by the iron manufacturer, thus giving them work to do for which they are not at all suited. If the latter is the case the iron manufacturer must be held responsible. Yet if we look a little more carefully into the subject we will find that this difficulty might have been avoided in many cases had firebrick manufacturers called their wares by the right name.

The term "high silica firebrick" has been so generally and so grossly misused in trade that the name naturally arouses an incredulous feeling, especially among iron manufacturers, who appreciate this situation of affairs. The majority of people in the iron trade, no doubt, are cognizant of the fact that firebrick are being sold for high silica brick, which, on the contrary, are as basic by nature as any fireclay brick can be made. We assume, in the first place, that nothing save the natural products of fireclay beds are employed in the manufacture of firebrick —viz., fireclay and firesand. Fireclay contains kaolinite (the silicate of alumina) and anhydrous silica (quartz). The latter substance exists

in the uncombined state and, being acid in character, by virtue of its ability to unite with bases at a high heat, the fireclay or brick of which it forms a part may correctly be regarded as an acid or neutral, highly siliceous or not, by the presence or absence of a large excess of uncombined silica. We certainly recognize alumina in fireclay of a basic nature. Pure kaolinite contains:

	Per Cent.
Siliac, SiO_2 =	46.3
Alumina, Al_2O_3 =	39.8
Formula	$Al_2O_3 2SiO_2 + 4H_2O$.

After glancing at the above figures we would not consider a green brick containing Al_2O_3 equaling 35 per cent. SiO_2 equaling 50 per cent., water equaling 10 per cent., as an extremely high silica firebrick; on the contrary. it could be justly criticized as running higher in alumina and lower in silica than the average.

To illustrate how some firebrick manufacturers have misrepresented their wares in several instances which have come directly under my observation, it may be stated that firebrick have been sold for high silica brick carrying SiO_2, equaling 90 per cent. When analyzed it has been found that they did not contain more than two-thirds as much silica, SiO_2, equaling 60 per cent., and Al_2O_3, equaling 35 per cent. It is quite evident that this percentage of alumina is only a trifle above that of the average firebrick.

The brands of brick to which I have particular reference are all similar in outward appearances. They are coarse in structure and sometimes quite friable, disintegrating as though there might have been preponderance, possibly 90 per cent., of rock-like material present in the brick mixture to destroy the plasticity and the complete bond of the product. To the naked eye the small grains slightly resemble tiny crystals of pure quartz or silica.

To disclose the actual relationship which the silica bears to the alumina in these brick, which have been sold for high silica firebrick, I will tabulate the results of a chemical analysis of one of them.

	Per Cent. A.	Per Cent. B.
Silica (total), SiO_2	53.21	87.74
Alumina, Al_2O_3	44.07	11.54
Lime, CaO	0.30	0.22
Magnesia, MgO	0.18	none.
Iron sesquioxide, Fe_2O_3	0.27	0.41
Alkali, chlorides	2.23	0.72

Every firebrick manufacturer knows that there are methods for making refractory brick containing as much as 85 to 90 per cent. of silica. An analysis of a true high silica firebrick is given in B.

Firebrick A has been said to contain 90 per cent. of pure silica and 10 per cent. of fireclay; that is to say, the brick mixture is made from ground quartz rock, practically pure silica, and fireclay combined in the above ratio. It is obvious that the burned product does not even approximate 90 per cent. of silica; therefore the only conclusion to be drawn from the analysis A is that the so-called ground rock is not pure quartz or anhydrous silica. After examining its structure, it is quite evident that the firebrick referred to contains 90 per cent. of calcined rock clay instead of ground quartz, and 10 per cent. of plastic or semi-plastic clay.

Can it be possible that in this enlightened age many of our firebrick manufacturers are laboring under such a sad delusion as that rock or flint clays are pure anhydrous silica? Judging from the number of instances in which a rock or flint clay firebrick has been pronounced a high silica brick by salesmen, it either points in that direction or else indicates a strong attempt on the part of the representatives of many of our firebrick companies to make their customers believe it. No, a high silica firebrick is not a rock clay brick, or *vice versa*, but is one which, by actual chemical analysis, will carry at least 85 per cent. of pure silica (SiO_2).

It is not safe or wise for iron or firebrick manufacturers to make an erroneous application of this term "high silica firebrick." Now, there are enough inaccurate language and false terms used in the scientific world without increasing this part of its vocabulary—either intentionally or ignorantly.

It is not necessary that I should go down to the fundamental principles of chemistry to discuss this matter. The term "silica," scientifically speaking, refers only to the pure oxide of silicon (SiO_2), of which white sea sand is a fair example. Rock clays are in no sense of the word pure quartz or silica, and should a firebrick manufacturer claim that he is making a high silica brick because he is putting 85 to 90 per cent. of crushed calcined or raw rock clay into his mixture, he is making a statement in relation to his wares which is absurd and untrue.

If the work calls for a firebrick containing a very large preponderance of silica, the more of this constituent that is introduced into the mixture the more efficient it will be, providing the excess of silica is not so great as to jeopardize its strength and toughness.

Beyond a certain limit a large percentage of silica renders a brick mixture very short and unmanageable in the process of manufacture, and likewise makes the burned product so friable that the slightest mechanical action will cause it to disintegrate. Its interior and exterior appearance stamps it as indelibly as does the structure of the Pennsylvania rock clay bricks, but let us not confound them, for mechanically they are very radically different. Break one of these firebrick in two, which has been made from the native Pennsylvania clays, and you will note at once their characteristic fracture—how uneven in size and coarse the grains are, but each individual particle, which to many may resemble a fragment of quartz, will yield practically the same results with respect to silica and alumina as I have tabulated in analysis B.

Hence refractories, so commonly spoken of as the Pennsylvania firebrick, are not a high silica firebrick, but usually carry alumina and silica in about the same proportion as the average sample of fireclay.

The Lignite Industry of North Dakota.

According to the *Am. Mfr.*, lignite is found in all the western half of North Dakota, cropping out of the bluffs and hillsides. In most localities there are three or four strata of it, the upper being from a foot to 3 feet thick, and the lower one from 5 to 30 feet thick. The upper veins are softer than the lower veins, and are too thin to be of any value. Most practical miners believe that still lower viens would be found if the shafts were sunk, and that these viens would prove to be harder than the ones now worked, but the industry of mining in the State is everywhere in a rather rudimentary stage, and there is no capital available to make experiments. A level is run in from the face of some bank convenient to a railroad, a track is laid into the opening, and the coal is taken out by the simplest and most economical method.

The mines now worked for shipping are at Sims, on the Northern Pacific, 35 miles west of Mandan; at Lehigh, 106 miles west of Mandan, and also at Minot, where the Soo road crosses the Great Northern, and at Burlington, a short distance from Minot, on the latter road. Mines worked by settlers to supply neighborhoods with fuel are numerous. Perhaps the most notable of these are in McLean county, north of Bismarck, where a superior quality of coal is found.

So vast are the lignite fields of North Dakota in their extent and so wide in their geographical distribution, that only such as are very near to a railroad track and present thick veins exposed for the most economical mining operations have any present commercial value. In other words, coal lands are worth no more than other lands unless they are contiguous to a railroad and unless the lower vein is thick and can be entered on a level.

The cost in carloads on the track at Fargo is $3.25 per ton. This is now the furthest eastern point of supply, but it will not be long before lignite will cross the Red River and become established as the favorite fuel in the northern Minnesota towns. At Mandan lignite costs $2; at Bismarck, $2.25; at Jamestown, $2.55; at Carrington, $2.90; at Leeds, $3.25; at Oakes, $3.10; and at Lisbon, $3.15. It is not possible to market it in South Dakota by reason of the excessive charges of the railroads operating in that State. They demand as much for hauling it from Oakes to Aberdeen, about 50 miles, as they charge for hauling Eastern coal all the way out from Chicago, about ten times the distance. Such rapid progress has lignite made in public favor during the past year or two, and so ample have been the demonstrations of the economy resulting from its use, that it is evident that this home fuel will soon almost wholly supplant Eastern coals throughout North Dakota, except for locomotive use.

The mine now working at Sims is on a 7-foot vein. The owners say that their coal compares with the best Pittsburgh coal in the ratio of 14 to 20, and with Iowa coal in that of 16 to 20. The freight rate to points of consumption is 25 cents a ton less than that from the Lehigh mines, which are 70 miles further west, and this difference is added to the coal so that the product of the two localities comes into equal competition at all places where it is sold. The Minot coal, which finds its markets along the lines of the Great Northern and Soo roads, is sold at the mines for $2 a ton. It is of no better quality than that mined at Sims and Lehigh. The coal field worked at Sims is broken by numerous ravines.

The Lehigh and East Lehigh mines at Lehigh, near Dickinson, work a 26-foot veim, but only 15 or 16 feet of coal is taken out. Rooms are excavated in the thick coal body each side of the entry, and sufficient

coal is left above to form an arched roof, which requires no timbering. The pillars between the rooms are "robbed" after the rooms have been fully blasted out, and then the mass of superincumbent clay, having a depth of about 50 feet, caves in. The process of mining is exceedingly simple. Holes are bored with a breast auger and dynamite shots put in to bring down the coal. A track runs into each room from the main line of the entry and the cars are loaded with fork shovels which allow the slack and fine coal to slip through the tines. All this fine stuff, although it is good coal, is left on the floor of the mines and only the lump coal is taken out in the cars. About 30,000 tons will be mined at Lehigh during the year and the product of the Sims mine will be about the same. At either place 100,000 tons could be mined annually.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Mansfield (Ohio) Gas Light Company the officers chosen were: Directors, S. E. Bird, H. M. Weaver, Joseph S. Hedges, E. H. Keiser, L. A. Strong, John McIlhenny, J. P. Seward and W. C. Hedges; President, S. E. Bird; Vice-President, H. M. Weaver; Treasurer, Joseph S. Hedges; Secretary and Superintendent, W. C. Hedges.

On the adjournment of the meeting of the Gas Company the annual meeting of the Mansfield Electric Light and Power Company was held, and the result reached was as follows: Directors, S. E. Bird, H. M. Weaver, Joseph S. Hedges, H. E. Bell, M. B. Bushnell, L. A. Strong and James Purdy; President, S. E. Bird; Vice-President, H. M. Weaver; Treasurer, Joseph S. Hedges; Secretary and Superintendent, W. C. Hedges. The named results show that the gas and electric lighting interests of Mansfield are still virtually and practically controlled by the gas men.

The Cary Brothers are rapidly strengthening the position of the Lodi (Cal.) Gas Company.

A proposition was made some days ago to the Council of Mt. Clemens, Mich., for the right to establish and operate a gas works in that place. The proposition was referred to a special committee. Mt. Clemens is the capital of Macomb county, Mich., and is in Clinton township, on the Clinton river, some 3 or 4 miles from Lake St. Clair, 25 miles north-northeast of Detroit, and 37 miles southwest of Port Huron. The Grand Trunk Railroad affords it rail communication and steamboats ply between the Mount and Detroit, on a daily table. It has important manufacturing interests, notably connected with the lumber industry and the production of salt. It is a wideawake, growing place, and has a population of close upon 6,000.

The Newark (N. J.) *News*, of the 10th inst., says: "The trustees of the new Newark Gas Company to day began the work of paying over the bonds of the consolidated concern to the stockholders of the former Newark and Citizens Gas Light Companies. The payments were made at the office of Mr. Eugene Vanderpool, one of the Trustees for the stockholders of the old Companies. Mr. Vanderpool stated that 90 per cent. of the bonds had been paid over, and about the same proportion of the cash balance of $600,000, or thereabouts, had been distributed among the shareholders of the former Newark Gas Light Company."

The Sedalia (Mo.) Gas Company applied to the City Council for a renewal of its franchise, asking for an extension of 30 years, with the right to charge a maximum rate of $1.75. The Council objected to the rate proposed, on the ground that the same was excessive; so the matter is in abeyance.

We regret to record the death, on the 2d inst., at his country seat in Elsdorf, not far from Cologne, of Mr. Otto Langen, one of the noted millionaires of Cologne, and a Director in the Otto Gas Engine Works Company, of Phhiladelphia, Pa. His death was quite sudden, and resulted from heart failure. He was about 60 years of age, and 12 children survive him, one of whom (Mr. Gustave Langen) is President of the Otto Gas Engine Works. Deceased was one of the merchant princes of Germany, and his estate of $20,000,000 was mainly acquired in the beet sugar trade, of which product he was one of the largest manufacturers in the world. He was a Director in the Gas Motoren Fabrik Deutz, the largest of its kind in Germany. Many decorations were conferred upon him for his ingenuity and enterprise, one being from Emperor William I. The only time that he visited the United States was in 1894, when the firm of Shchleicher, Schumm & Co., who originally introduced the Otto gas engine in America by direct license from the European patentees, ceased to exist, and was succeeded by the present Otto Gas Engine Works Company, so well known to the gas fraternity.

Mr. T. H. Bruen, of Tallahassee, Fla., has been appointed Superintendent of Construction for the Tampa (Fla.) Gas Company. Work on the buildings has been commenced, and will be carried right on to their completion.

"E. P. C.," writing from San Francisco, Cal., under date of October 1st, says: "The Santa Barbara (Cal.) Gas Company is having a complete, and practically new, works constructed. The apparatus is being furnished by the Western Gas Construction Company, of Fort Wayne, Ind., and consists of a double superheater Lowe apparatus, with generator and superheater 4 feet in diameter, two purifiers, 8 feet by 10 feet by 4 feet, and a 7-foot station meter. The boiler is 42 inches by 10 feet. This will be a model plant and the most complete and capable works of its size on the Pacific Coast. In fact, it will be able to meet the gaseous demands of Santa Barbara for many years to come. The buildings are of brick, the main one being 90 feet 5 inches by 28 feet 7 inches, and will afford commodious housing for boiler, generator and purifying rooms. The station meter room will also be ample for the office requirements of the Superintendent. The roofs are of corrugated iron. Mr. E. C. Jones, Superintendent of the San Francisco Gas Company, is the engineer in charge of construction, and the buildings are from his designs. The work is nearing completion.——The Bakersfield (Cal.) Gas and Electric Light Company is having some changes made and remodelling done for the purpose of installing a set of the Western Gas Construction Company's Lowe water gas apparatus.——The tank steamer Bawnmore, belonging to Grace & Co., of San Francisco, and which recently discharged 5,000 barrels of Peruvian oil at Portland, Ore., for the Portland Gas Company's winter supply for its United Gas Improvement Company's type of water gas plant, while returning south with a mixed cargo for Central and South American ports, went ashore on the Oregon coast, and is a total wreck. Mr. C. F. Adams is undoubtedly glad he got his oil first. I understand the water gas plant at Portland was put in operation a short time ago.——The San Francisco Gas Company is replacing a large number of electric lights in all parts or sections of the city with Welsbach burners."

The appeal of the Bethlehem (Pa.) South Gas and Water Company, the works of which are located at Fountain Hill, from the assessment of $80,000 placed on the real estate by the County Commissioners for specific purposes of taxation (local), was recently argued before Judge Albright. Counsel for the Company contended that as the Company's capital stock (which stood for all its possessions) was taxed by the State it was thereunder or thereby exempted from local taxation; and Judge Albright concurred in the contention, for he signed the following order: "The real estate being indispensably necessary to the exercise of the privileges granted in its charter, the Company is not subject to taxation for county, school, road or borough purposes."

The Grand Rapids (Mich.) Gas Company has leased a room in the Ledyard Block adjoining its present office, and will connect both by means of an arched passageway. The entire floor will then be remodelled, and a goodly portion of the space will be allotted to a liberal display of gas cookers, heaters, improved burners, etc.

The Berlin Iron Bridge Company, of East Berlin, Conn., has just completed a highway bridge over Still river, at New Milford, Conn., consisting of one span of 170 feet, with a roadway 20 feet wide in the clear. The bridge is 105 feet above the bed of the river.

The commercial electric lighting system of the Salt Lake and Ogden (Utah) Gas and Electric Light Company is being rebuilt throughout.

The New Castle (Pa.) Electric Company, which is a result of the merger of the local gas and electric lighting interests of the place, has perfected the following organization: President, Cowden Bleakley; Vice-President, J. S. Hays; Treasurer, Robert Peebles; Secretary, Thomas D. Flick. Mr. Flick was formerly Purchasing Agent and Treasurer of the Lawrence Gas Company, of New Castle.

The Hartford City (Conn.) Gas Light Company has given a second order for water gas apparatus to the United Gas Improvement Company, a machine of "two-thirds of a million" daily capacity having been arranged for, to supplement the two present machines of a quarter

of a million each. Pronounced increase in output, General Harbison says—and who could better know?—is the impelling reason for this addition to the Hartford Company's plant capacity.

We regret to report the death of Mr. Franklin Leonard Pope, Past President of the American Institute of Electrical Engineers, and brother of Mr. Ralph W. Pope, the present Secretary of the Institute. Mr. Pope's death resulted from an electric shock; the press despatches detailing the tragic event said: "Franklin Leonard Pope was instantly killed by a shock of 3,000 volts, in the cellar of his house this evening. He was the Manager of the Great Barrington (Mass.) Electric Light Company, the principal buildings of which are at Housatonic, 5 miles north of Pittsfield. To facilitate the operations of the plant he had placed in his cellar a large and powerful converter. When the power was turned on this evening he visited the cellar to adjust the bearings. His family upstairs heard a heavy fall, and, upon investigation, found Mr. Pope dead on the floor, beside the converter. Doctors say death was instantaneous." Mr. Pope was born in Great Barrington, Mass., in 1840, and from his very boyhood was interested in the study and practical development of electric currents for commercial purposes, and in 1862 was in the service of the American Telegraph Company, in the New York offices. Later on he engaged in the business of patent attorney, making a specialty of electrical inventions, and to his genius may be traced many important advances in the art of telegraph printing, railroad signalling, and so on. At one time he was patent attorney for the Western Union Telegraph Company, and succeeded the late President of that Company (Dr. Norvin Green) in the Chairmanship of the American Institute of Electrical Engineers—1886. He was a prolific, forceful and instructive writer, and personally was a most amiable man. His widow, two daughters and a son survive him. The funeral services were celebrated at Great Barrington, Mass., on the afternoon of the 16th inst.

The management of the New London (Conn.) Gas Light Company, despite all the protestations of advancement to be made "when the proper time came," seems to be about as progressive as ever, if one may judge of the following, from a recent issue of the New London *Day:* "This morning the Gas Company shut off the entire city without giving its customers notice. The result was that for several hours *The Day* was unable to use its type setting machines. Part of a main on Federal street was replaced, and the Company could not think of any other time or method to do the work. Practices like these may be considered up-to-date and business like in New London, but they would not be tolerated in any other city in the country."

Our prediction in the Journal issue, dated the 7th inst., that the next Board of Trustees of the Wheeling (West Va.) City Gas Works would be Messrs. Buckman and Pollock and Dr. Ford, has since been borne out. The working force so far appointed by the Board—that is, according to advices received by us under date of the 12th inst., is: Secretary of the Board, Godfrey Schul; Assistant Secretary, John G. W. Beier; Inspector, William Schenck; Meter Takers, B. Schuler and Joseph Klug; Collector, Louis Seabright; Supt. of Works, Frank Thompson.

Engineers' Department,
The Standard Gas Light Company of the City of New York,
Foot of East 115th St., New York, Oct. 15, 1895.

To the Editor American Gas Light Journal: On page 606 of your valuable Journal of the 14th inst., under the heading "Briefly Told," it is stated that Mr. Egner's paper on "The Storage of Oil at Gas Works" is a theme that should greatly interest the sage proprietors of the Standard Gas Light Company, of New York. The well-known ability of the gentleman named is sufficient guarantee that his paper will not be devoid of interest; but will you kindly explain your reason for assuming that the paper will be of greater interest to the Standard than to other gas companies in this city? Also, what grounds you have for the inference that the Standard does not store oil in tanks that are "sound and tight?" Very truly yours, G. H. Weeks, Supt.

It is, just as Mr. Weeks pleasantly writes, fairly well known amongst the gas fraternity that Mr. Egner is a man of ability in his profession, and that he is also well qualified to build a "sound and tight" storage tank; wherefore he should have no difficulty in writing interestingly on the topic he has chosen. The reason why we inferred that this subject of oil storage was a moot one with the Standard Company last week lies in the following matter which appeared in the issue of the New York *Herald*, dated the 10th inst. It is true that tanks, of themselves, are not mentioned in the *Herald's* account of the trouble which so suddenly came upon the Standard folks, but the fact is that the pipes to or from the tanks are mentioned; and so we submit that as a whole is the sum of all its parts, we rather imagine we were not very wide of truth in our surmise that Mr. Week's employers were a week ago quite concerned in the matter of safely retaining oil. With the remark that an ordinary pair of trousers would not be of much account without buttons, we herewith give the *Herald's* statement of the recent troubled condition of the Standard's works on Pleasant avenue:

"An explosion caused great alarm to residents in the neighborhood of 115th street and Pleasant avenue, at half-past six o'clock yesterday morning. As the Standard Gas Light Company occupies the territory between 114th and 116th streets, from Pleasant avenue to the Harlem river, it was at first supposed that the works of the Company had exploded and that dire destruction had been caused. Persons rushed from their houses and saw a column of flame at least 50 feet high ascending from a great hole that had been blown in 115th street, near the river, and also saw the surface of the Harlem river was ablaze between the 115th and 116th street piers. The flames seized the pier at the foot of East 115th street and the foot bridge leading to the boat houses of the Ward's Island ferry, just below the pier. Chief of Battalion Short soon had three engines and two trucks on hand. The Chief made an investigation and decided that the works of the Gas Company and the naphtha tanks nearby, containing enormous quantities of oil, were in no danger. It was an easy matter to extinguish the flames on the foot bridge, but more difficult among the inclosed timber of the pier. It was three hours before the flames were extinguished. It was found that the ground between the gas works and the river and the cribwork of the pier had been completely saturated with oil from a leak in an oil pipe. The leak, which was 100 feet from the river, was in a drain pipe that conveyed the refuse oil from the gas works to a set of small tanks near the 115th street pier, alongside of the large naphtha tanks in which is stored oil used in carbonizing the gas."

The new holder on the Rockland (Me.) Company's plant is in duty, and is working up to the guarantee of its builders.

There is some talk of restoring the old gas works at Cold Spring, Putnam county, N. Y.

A correspondent at Hamilton, O., writing to us under date of the 12th inst., says that on the 9th inst. the Trustees of the Hamilton city gas works met in special session to act on the resolution adopted by the City Council ordering the lighting of gas lamps where found necessary by the absence of electric arc lights. They also reduced the price of gas from $1 to 80 cents per 1,000 cubic feet. As an inducement to citizens to take gas from the municipal plant the Trustees resolved to make all connections from the gas mains to the meter free of any charge whatever up to the 1st of November. After that date no charge will be made for service from the street main to the curb, and from the latter point to the meters only the actual cost of making connections will be charged.

Some days after the action above noted was taken, the proprietors of the Hamilton Gas Light and Coke Company notified the citizens that its rate for gas would be the same as that charged by the city, the reduction to take effect on November 1st.

The injunction suit of Mr. George Ohe, Jr., against the Belleville (Ills.) Gas Light and Coke Company, has been withdrawn, the Company having purchased from Ohe the lots over which it wishes to run a switch to the Cairo Short Line.

Mr. William Oates, of Philadelphia, is rebuilding three benches of 5's in the retort house of the city gas works, Alexandria, Va.

Among recent contracts by the United Gas Improvement Company for Standard Lowe water gas apparatus is one with the Pacific Gas Improvement Company, of San Francisco, Cal., for a plant of upwards of 1,000,000 feet daily capacity. Still another contract is that made for the installing on the works of the Colorado Springs (Col.) Gas and Electric Company a set of standard Lowe form water gas apparatus, up to a daily capacity of from 250,000 to 300,000 cubic feet. This, the second set of water gas apparatus installed by the Springs Company, will replace the old "oil-water" gas apparatus constructed by a former manager at that point, and will become the principal producing machine of the Company.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, OCTOBER 21, 1895.

Director Thompson on the Needs of the Philadelphia Gas Works.

The following is from a recent issue (October 12) of the Philadelphia *Bulletin:*

As a result of a personal investigation of a number of complaints which have been made by consumers, of the poor quality of gas furnished by the city, Director Thompson has found several causes to exist which he will remedy as quickly as he can secure the money from Councils to provide for the work. He has found that there has been an increase in the consumption since the first of the present year of 275,000,000 feet, or an average of about 1,000,000 feet per day, which is believed to be largely due to the use of gas as a fuel since the reduction of the price to $1 per 1,000 feet.

This enormous increase has not been met by any increase in the capacity of the works, and the plants now in operation are taxed to a point so far in excess of the normal output that the pressure necessary to provide a full supply is not sufficient.

Many of the mains laid in the streets years ago, which were of ample capacity for the consumption at the time, are now entirely too small, and their capacity has been greatly diminished by the corrosion of iron. Many of the old mains have been found to have been entirely eaten through by the rust, allowing the gas to escape into the surrounding earth.

Examinations made of some of the buildings in which an insufficient supply was received reveal that the service pipes, from the street main to the meter, are too small to carry a supply for the number of burners now in use. In other cases the trouble was found to be caused at the burners by almost the entire flow through the service pipe being consumed in heaters and stoves.

In the district supplied from the 15th ward works it was found that two new stacks of benches had been started, as the demand upon the works increased, and before the new stacks had become thoroughly heated, large quantities of air were forced into the holders and from these to the street mains. This reduced the quality of the gas furnished to a noticeable degree for several days, and was directly traceable to the origin of a number of the complaints.

"More holders are imperatively necessary, as one of the first measures of relief," said Director Thompson to-day. "The old and worn out street mains must be replaced and larger ones must take the place of those which are unequal to the demands made upon them. The fault in the house connections must be remedied by the property holders by the introduction of large ferrules and pipes, and when we get our work finished there can be no cause of complaint.

"I will place what is known as a 'pusher' at the 15th Ward works as soon as I can obtain an appropriation from Councils. It will cost about $40,000, but it will increase the pressure and overcome our present difficulty to a large degree. The 'pushers' have been thoroughly tested and have given satisfaction, and I am not afraid but that they will relieve us of much trouble.

"I propose to take every measure possible to improve the gas works and propose to make it as good in every way as any bureau in the city government. It can readily be seen that it will take both time and money to make the plant what it should be, but I think I will have the support of the people and Councils in the efforts I am making.

"It is a matter in which every taxpayer is interested, for the gas works are turning in large amounts of money to the City Treasury every year, and if it has paid in the past it will pay all the greater as the consumption increases and especially if by the renewal of old and worn-out mains and the introduction of new methods, the cost of production can be reduced.

"I do not know how much the gas costs at the meter, but I will ascertain at the close of the year and I will then be better able to figure on the profits of the Bureau than I am at this time. I am investigating the whole subject of the manufacture and distribution, and as rapidly as I find improvements can be made we will adopt them. We have already made a number of changes from the old antiquated methods which have been continued from year to year, and more will be made as rapidly as possible."

Painting Iron Work.

In a recent communication to the American Society of Civil Engineers, Mr. E. Gerber gives the results of a careful investigation into the present state of a number of bridges which had been painted with one of several classes of paint. In all cases rust was found to a greater or less extent, occurring always in spots in the center of clean metal.

Most of this, however, was thin, and was as bad in new structures as in old. It was, however, found that the iron oxide paints adhered more firmly to the metal than the lead paints, only one case being found in which the latter adhered well and was tough. It is, however, suggested that much of this brittleness was due to adulteration of the oil by turpentine, benzine, or other petroleum products. There is more likelihood of such adulteration with lead paints than with iron, as they are more difficult to spread, and there is thus more temptation to dilute the oil.

In some cases bridges coated with iron oxide 11 or 12 years ago were still in good condition, without having been repainted. Only two of the bridges examined had been painted with carbon or asphaltum paints, but the condition of things in these two cases was found to be not altogether satisfactory, as in neither case was the coating tough and adherent. The metal had, however, been protected by them. Mr. Gerber considers that too little attention has, in the past, been paid to thoroughly cleaning the metal before the first coat of paint is applied. Most of the rust spots found had apparently been there from the outset, and had done no harm so long as not too far advanced. The best plan of securing clean surfaces, in Mr. Gerber's opinion, would be to coat the metal with linseed oil as it left the rolls.

The Market for Gas Securities.

The feature of the week in the market for city gas shares was Consolidated, which, on transactions of a very voluminous nature for this security, sold up to 148 yesterday—Thursday, 17th inst. At time of writing (noon, Friday), trades are reported to have been effected at 147½, with that figure bid for more stock. Yesterday 3,110 shares were traded in on the Exchange. The net result for the week is a gain of 3 points on the bid rate, and our belief is that the gain in values in the shares will be gradual and certain. The output of the Company is showing marked gains. Equitable is bid for at 199, and Mutual is in demand at 180, but no stock seems to come upon the market. New York and East River shows no change, and a like remark applies to Standards. The latter, however, are frequently inquired for by shrewd investors. The Brooklyn quotations are as they have been for months, but we believe there is some probability that the Equity, as a disturbing factor in the Brooklyn situation, is all but eliminated. At any rate, the rumor to-day was that the Trask interest in the Equity Company had been taken over by other parties. Chicago gas was fairly steady during the week, and to-day the opening price came in at 68¾ to 69. It is understood that the Flower syndicate plan of extricating the Trust from its difficulties is certain to succeed.

Bay State gas is once more in the ascending scale, but on what reasonable ground the advance is based we fail to discover. We believe it is perfectly safe to say that the next dividend on Consumers, of Jersey City, will be at the rate of 6 per cent., despite the oft-repeated rumor of late that it was to be made a 7 per cent. stock. It is very firm, at 95 bid. Baltimore Consolidated is 65¼ bid, and it will go higher. Western, of Milwaukee, has boomed up to 68. Lacledes are dull, the best bid to-day for the common being 26¼, while the range in the preferred is 85 to 88. The securities of the new Newark (N. J.) Company are being traded in, and we know of an offer of 75 for the stock. The bonds are quoted at 120 to 125. The Philadelphia *Inquirer*, of the 17th, said that the syndicate which has been negotiating for the Gas Light Company, of Syracuse, N. Y., has succeeded in acquiring the property, but we rather doubt it.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

October 21.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	147¼	148
Central	500,000	50	150	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	199	..
Bonds, 6's	1,000,000	1,000	106	..
" 1st Con. 5's	2,300,000	1,000	114	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	180	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50	79	80¼
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	31	32
Preferred	2,000,000	100	54	57
Bonds	3,500,000	1,000	95	96
Richmond Co., S. I.	348,650	50	30	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	68	69
Preferred	5,000,000	100	108	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109	..
Yonkers	299,650	50	112	..
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	330,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	103	..
Peoples	1,000,000	10	90	..
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	225	..
" Ctfs	700,000	1,000	99	100
Williamsburgh	1,000,000	50	210	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	50	24¼	24⅝
" Income Bonds	2,000,000	1,000	..	80
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	78	80
2d " " "	3,000,000	1,000	53½	..
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	.....	..	95	..
Chicago Gas Co.	25,000,000	100	68¾	69
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	63	66
1st Mortgage	1,085,000	..	91	93
Consumers, Jersey City	2,000,000	100	95	99
" Bonds	600,000	1,000	103	.
Cincinnati G. & C. Co.	7,000,000	100	203¾	203
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	.....	.	..	41
Consolidated, Baltimore	11,000,000	100	..	66⅛
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,400,000	..	..	..
Detroit	4,000,000	..	29½	30¼
" Con. Bonds	4,312,000	..	75	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	79	80⅛
" Bonds	2,000,000	..	84	86
Hartford	750,000	25	130	135
Indianapolis	2,000,000	..	147	152
" Bonds, 6's	2,650,000	..	106	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	83	86
Bonds	1,000,000	1,000	87½	89⅛
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	26¼	..
Preferred	2,500,000	100	85	88
Bonds	9,084,400	1,000	97	98
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	..
New Haven	.....	25	225	..
Oakland, Cal.	.....	..	46¼	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Syracuse, N. Y.	500,000	25	..	..

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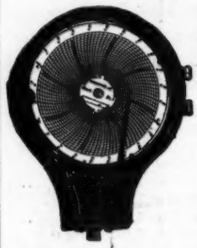

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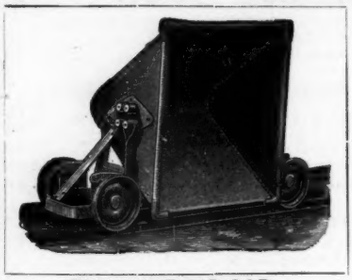

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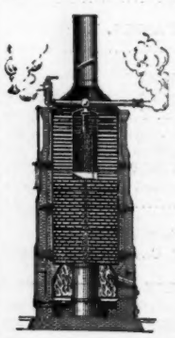

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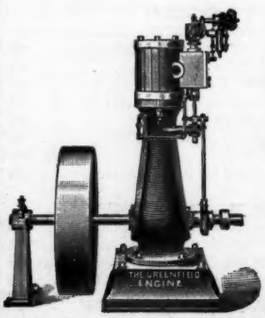

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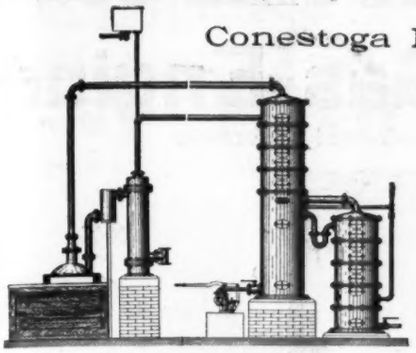

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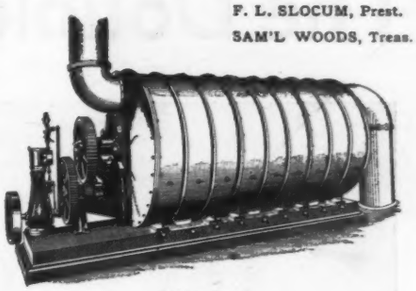

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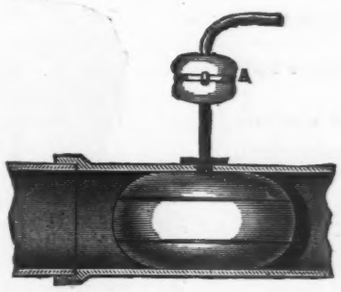

These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficiently inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

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5	"	"	1.05	20	"	"	12.00
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10	"	"	3.75				

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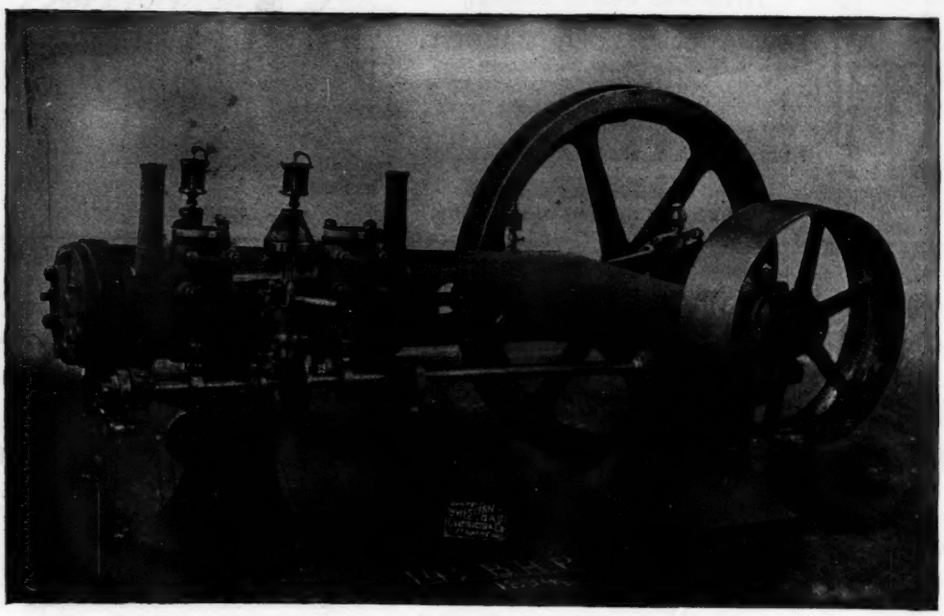

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For General Work and Isolated Electric Plants.

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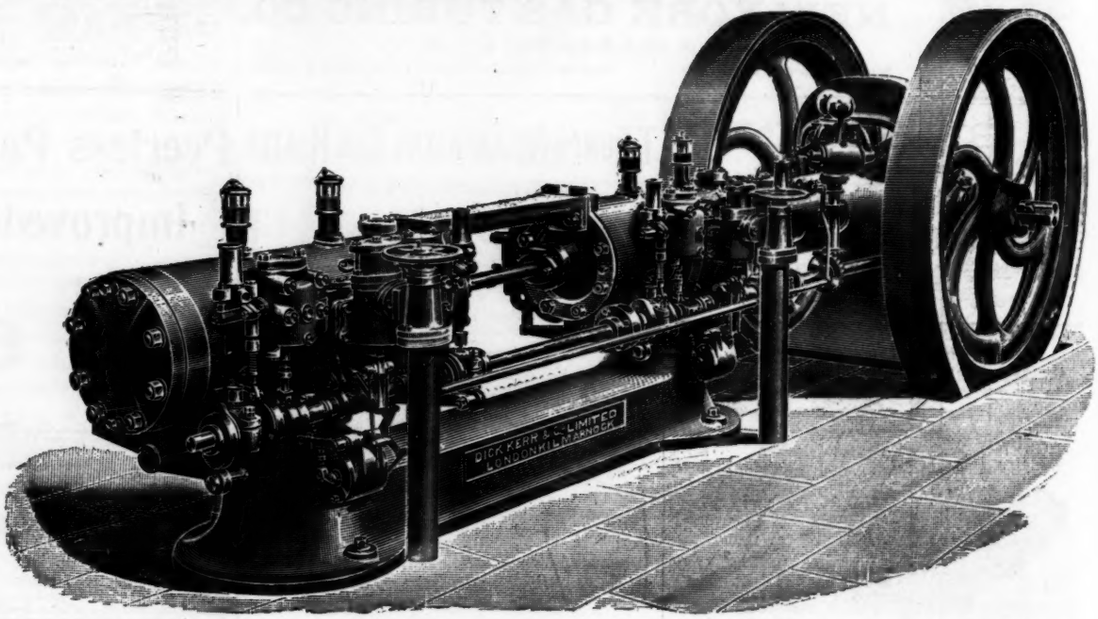

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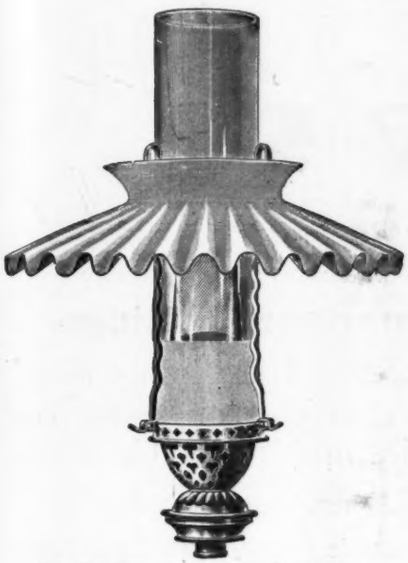

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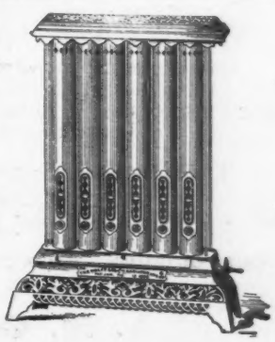

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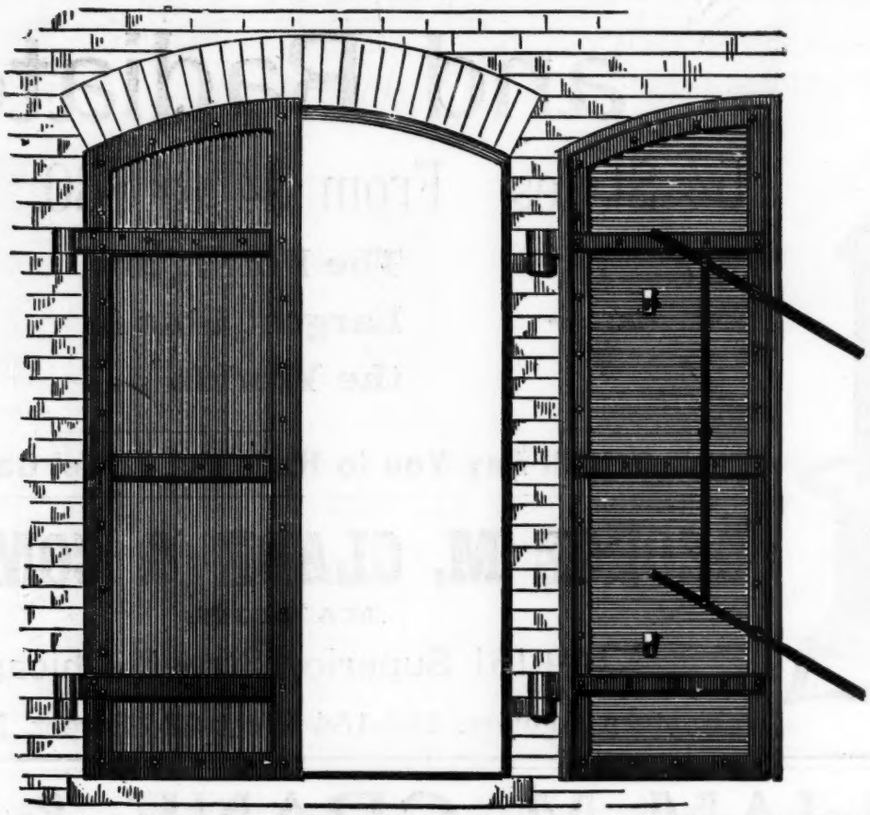

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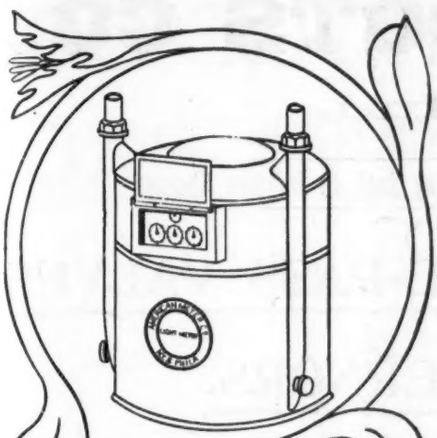

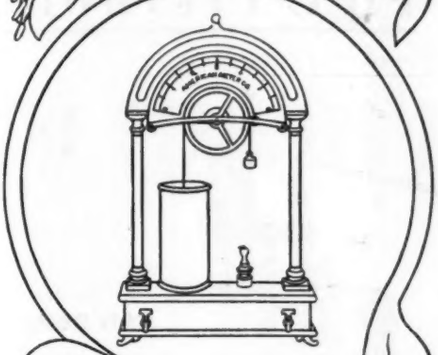

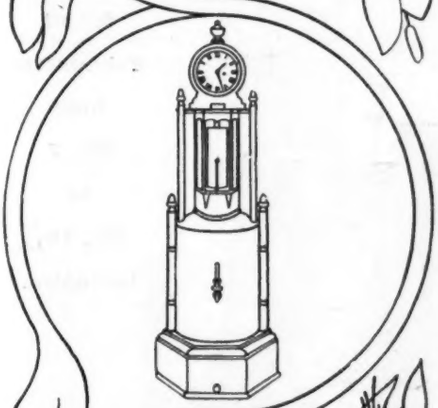

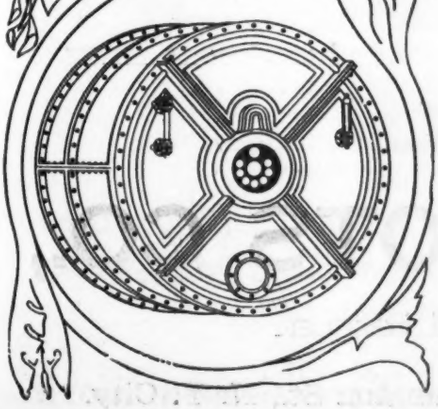

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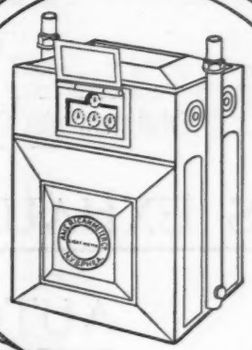
PUBLIC LIGHTING TABLE.

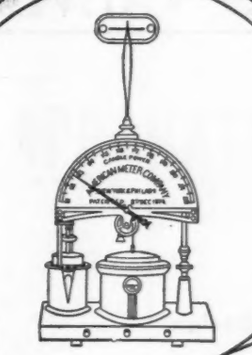
NOVEMBER, 1895.

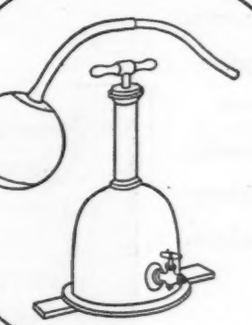
Day of Week.	Table No. 1. Following the Moon.			Table No. 2. New York City. All Night Lighting.	
	Date.	Light.	Extinguish.	Light.	Extinguish.
				P.M.	A.M.
Fri.	1	No L.	No L.	4.45	5.35
Sat.	2	No L. FM	No L.	4.45	5.35
Sun.	3	No L.	No L.	4.45	5.35
Mon.	4	5.20 PM	6.50 PM	4.45	5.35
Tue.	5	5.20	7.40	4.40	5.45
Wed.	6	5.20	8.40	4.40	5.45
Thu.	7	5.20	9.50	4.40	5.45
Fri.	8	5.20	11.00	4.40	5.45
Sat.	9	5.20 LQ	12.20 AM	4.40	5.45
Sun.	10	5.20	1.30	4.40	5.45
Mon.	11	5.20	2.50	4.40	5.45
Tue.	12	5.20	4.00	4.30	6.00
Wed.	13	5.20	5.50	4.30	6.00
Thu.	14	5.20	5.50	4.30	6.00
Fri.	15	5.20	5 50	4.30	6.00
Sat.	16	5.20 NM	5.50	4.30	6.00
Sun.	17	5.10	5.50	4.30	6.00
Mon.	18	5.10	5.50	4.30	6.00
Tue.	19	5.10	5.50	4.25	6.00
Wed.	20	5.10	5.50	4.25	6.00
Thu.	21	8.10	5.50	4.25	6.00
Fri.	22	9.10	5.50	4.25	6.00
Sat.	23	10.20 FQ	5.50	4.25	6.00
Sun.	24	11.20	6.00	4.25	6.00
Mon.	25	12.20 AM	6.00	4.25	6.00
Tue.	26	1.10	6.00	4.20	6.10
Wed.	27	2.20	6.00	4.20	6.10
Thu.	28	3.20	6.00	4.20	6.10
Fri.	29	4.30	6.00	4.20	6.10
Sat.	30	No L.	No L.	4.20	6.10

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146 30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45







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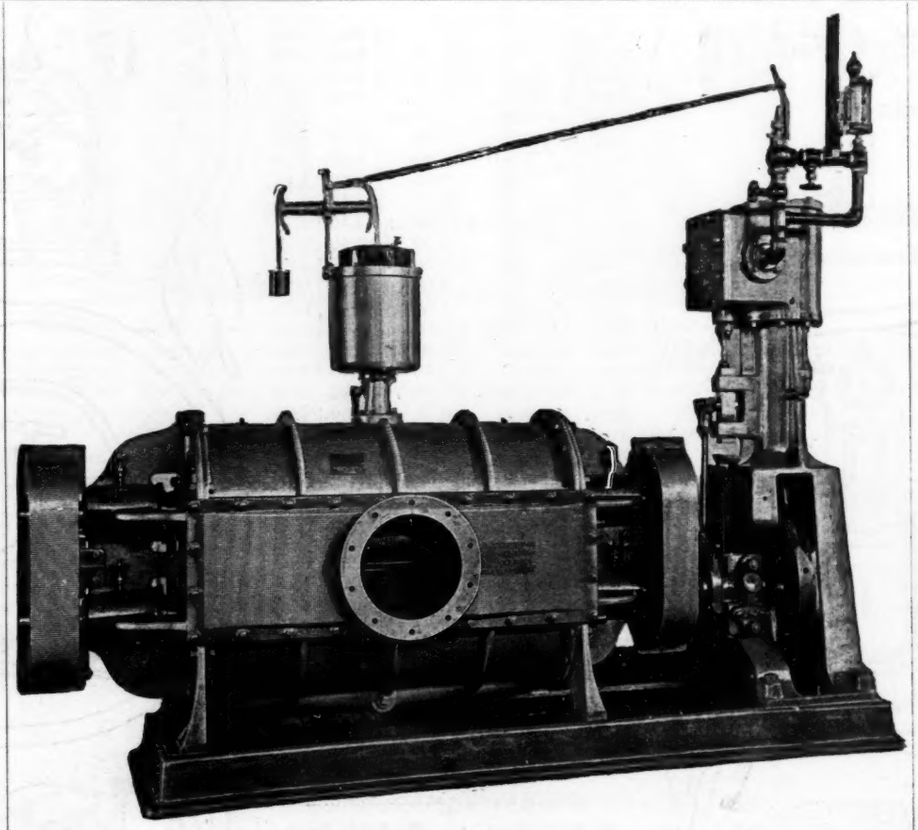

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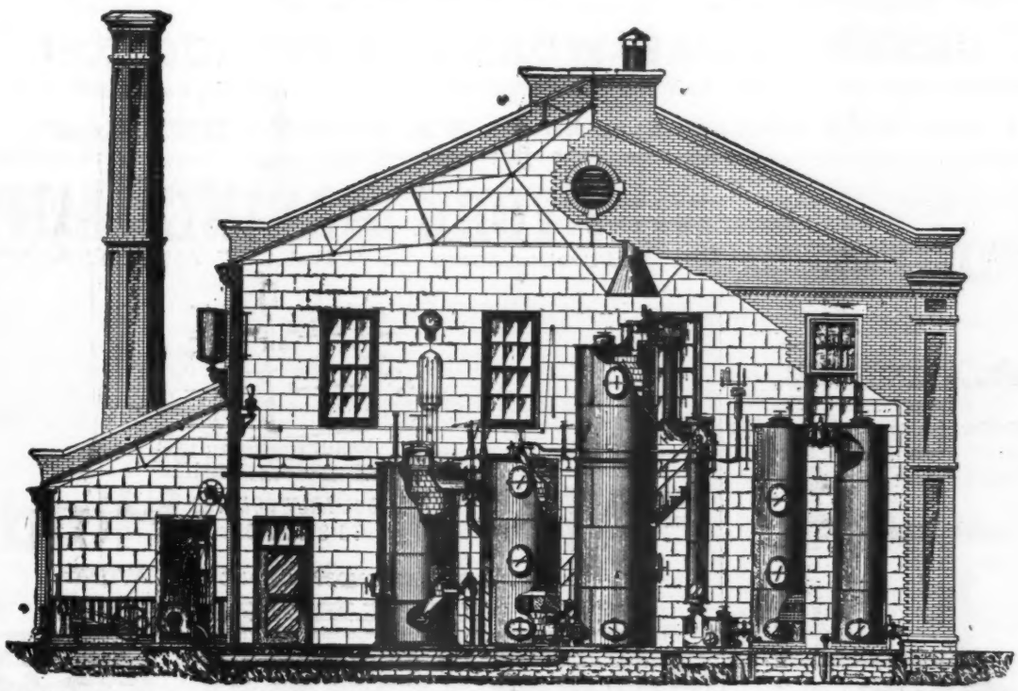

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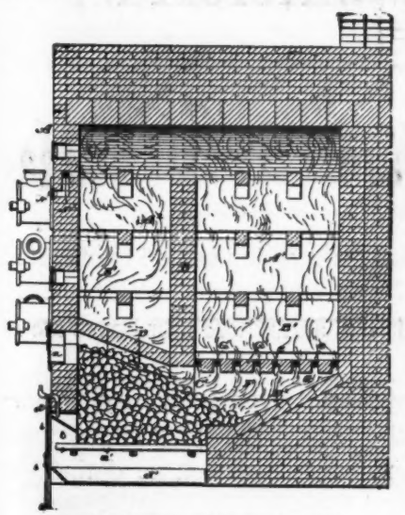

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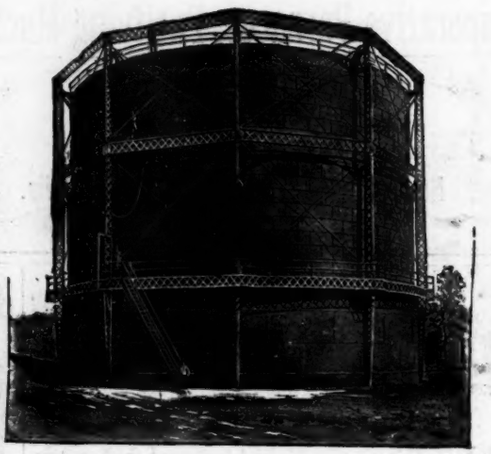

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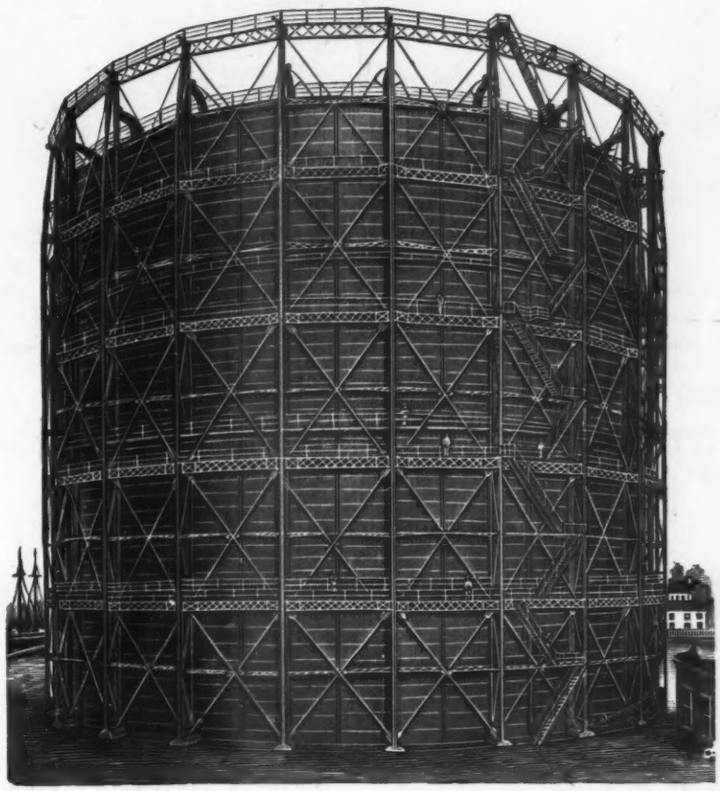

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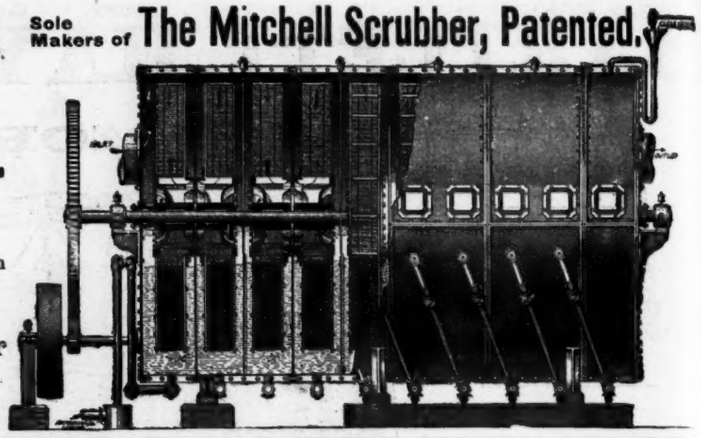

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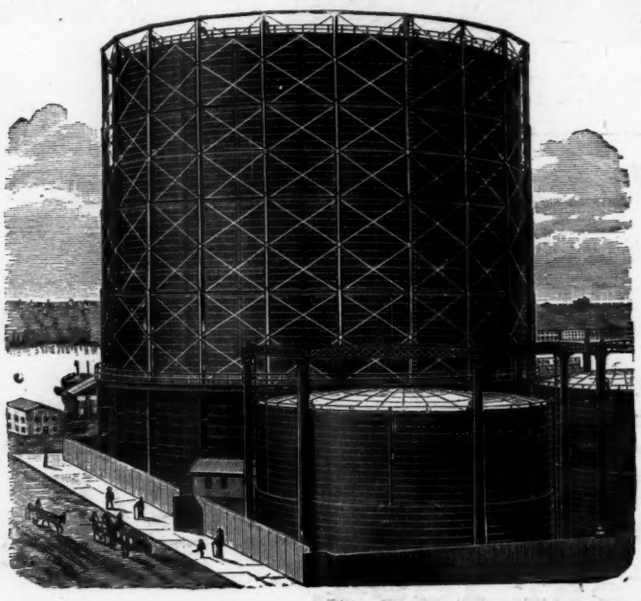

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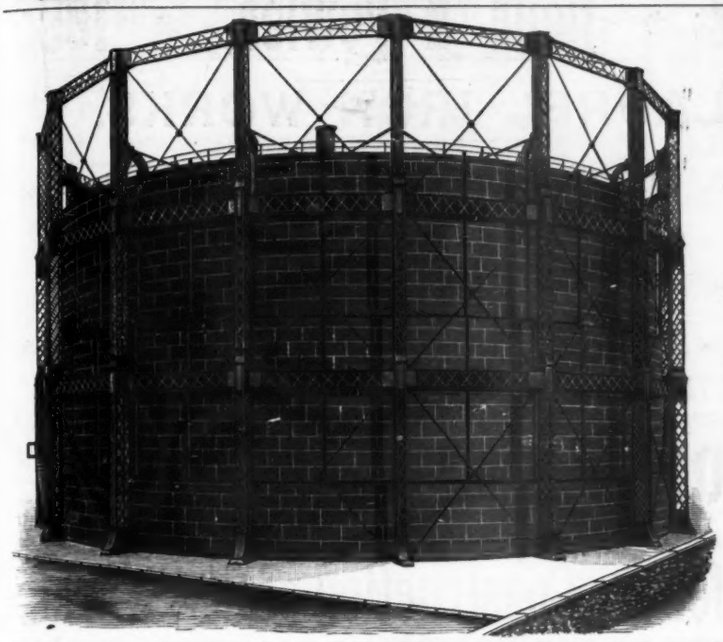

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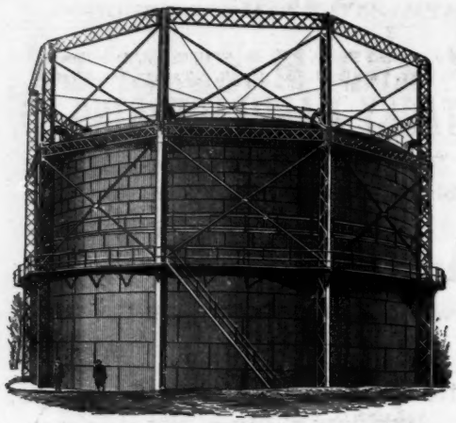

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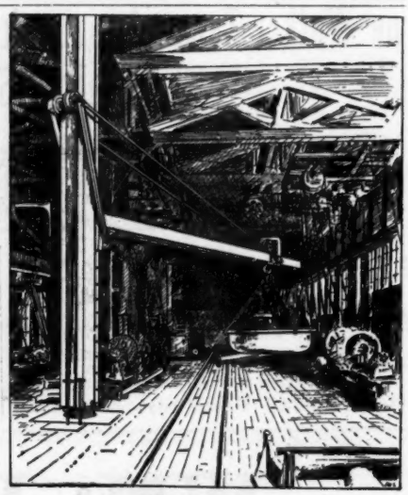

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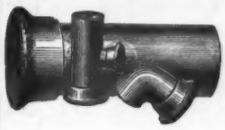

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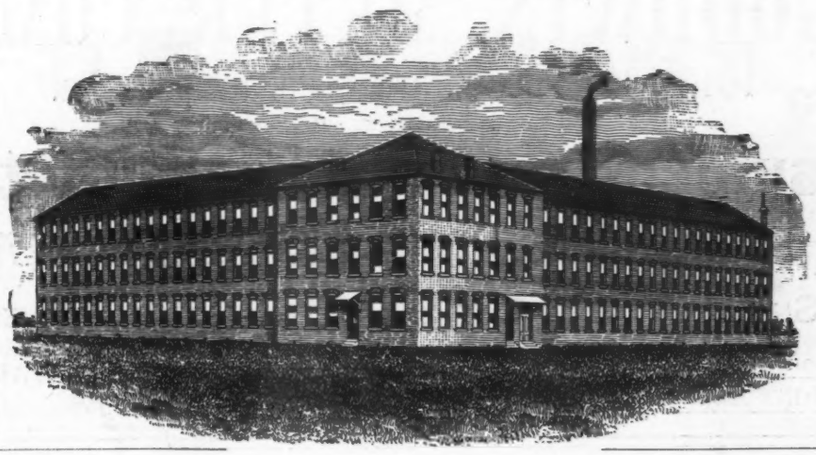

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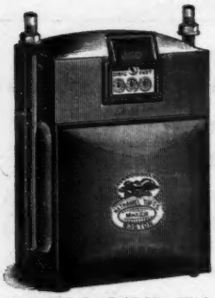

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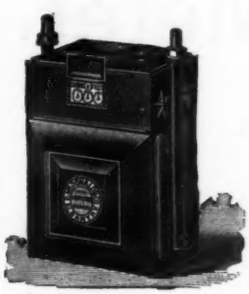

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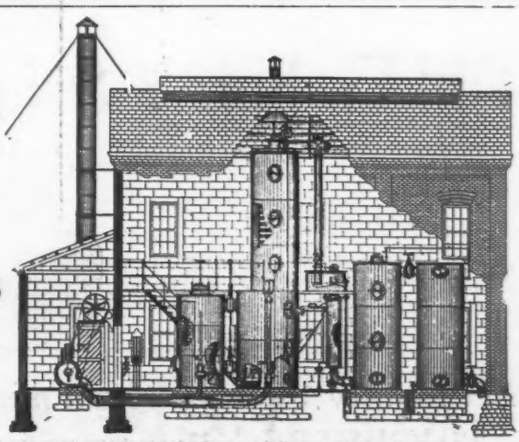

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